BRH/DEP 70-28

PB195969

# PRESENT FEDERAL CONTROL of HEALTH HAZARDS from ELECTRONIC PRODUCT RADIATION and OTHER TYPES of IONIZING RADIATION (as of November 1969)

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Environmental Health Service

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
Springfield, Va. 22151

217

## DIVISION OF ELECTRONIC PRODUCTS

### List of Publications

The following reports published as part of this series by the Division of Electronic Products, Bureau of Radiological Health, are available from the National Technical Information Service, Springfield, Va. 22151. Price is $3.00 for paper copy and $0.65 for microfiche. The PB number, if indicated for a report, should be cited when ordering.

| | Title |
|---|---|
| TSB-1 | Instrument for Measurement of X-ray Emission from Television Sets (January 1968) (PB 178 808) |
| TSB-2 | A Pilot Survey of X-radiation Emissions from Color Television Receivers (In Pinellas County, Florida) (June 1968) (PB 178 809) |
| TSB-3 | A Survey of X-radiation from Color Television Sets in the Washington, D.C., Metropolitan Area (March 1968) (PB 178 810) |
| TSB-68-4 | Biological Aspects of Microwave Radiation - A Review of Hazards (July 1968) (Reprinted August 1969) (PB 185 964) |
| TSB-5 | Report of Preliminary Measurements of Electromagnetic Radiation Fields Near Microwave Ovens (December 1968) (PB 185 967) |
| DEP-69-1 | X-radiation Control Programs in the Color Television Industry - Summary Report on Visits to Manufacturers - May 1968-December 1968 (March 1969) (PB 185 979) |
| DEP 69-2 | A Field Method for the Determination of Lead in Glass Used for Shielding Television Receiver Components (December 1969) (PB 189 703) |
| BRH/DEP 70-1 | X-ray Emission from Cold-Cathode Gas Discharge Tubes Used for Educational Purposes (February 1970) (PB 189 390) |
| BRH/DEP 70-2 | Report of Tests Made on the Westinghouse Panoramix® X-ray Machine (March 1970) (PB 190 399) |
| BRH/DEP 70-3 | Description and Evaluation of a Fluoroscopic Screen Visual Brightness Comparer (March 1970) (PB 190 870) |
| BRH/DEP 70-4 | Evaluation of a Norelco-Pitchford Portaspec® Portable X-ray Spectograph (March 1970) (PB 190 876) |
| BRH/DEP 70-5 | A Study of Head and Neck Exposures from Panoramix® Roentgenography (March 1970) (PB 190 964) |
| BRH/DEP 70-6 | Laboratory Testing and Evaluation of Color Television Receivers Acquired During the In-Plant Survey (March 1970) (PB 191 090) |
| BRH/DEP 70-7 | A Comparison of Microwave Detection Instruments (April 1970) (PB 191 395) |
| BRH/DEP 70-8 | Development of Liquid Crystal Microwave Power Density Meter (May 1970) (PB 191 396) |
| BRH/DEP 70-9 | Product Testing and Evaluation of Giant View® TV Projector (May 1970) (PB 191 906) |
| BRH/DEP 70-10 | Survey of Selected Industrial Applications of Microwave Energy (May 1970) (PB 191 394) |

(continued on inside of back cover)

BRH/DEP 70-28

# PRESENT FEDERAL CONTROL of HEALTH HAZARDS from ELECTRONIC PRODUCT RADIATION and OTHER TYPES of IONIZING RADIATION (as of November 1969)

Division of Electronic Products

November 1970

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Environmental Health Service
Bureau of Radiological Health
Rockville, Maryland 20852

The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such products by the U.S. Department of Health, Education, and Welfare, Public Health Service.

# FOREWORD

This report is one of a series of eight Bureau of Radiological Health staff documents used in the preparation of the "Report to the Congress on Studies Conducted Pursuant to Section 357 of the Radiation Control for Health and Safety Act of 1968, Public Law 90-602." A number of projects were established to study and report on various aspects of radiation control.

The Bureau of Radiological Health, formerly the National Center for Radiological Health, carries out a continuing national program designed to reduce the exposure of man to hazardous ionizing and nonionizing radiation.

The Bureau publishes its findings monthly in *Radiological Health Data and Reports*, Public Health Service numbered publications, appropriate scientific journals, and technical report series for the Bureau's divisions, offices, and laboratories.

The technical reports series allows comprehensive and rapid publishing of the results of intramural and contractor projects. The reports are distributed to State and local radiological health program personnel, Bureau technical staff, Bureau advisory committee members, university radiation safety officers, libraries and information services, industry, hospitals, laboratories, schools, the press, and other interested individuals. These reports are also included in the collections of the Library of Congress and the National Technical Information Service.

I encourage the readers of these reports to inform the Bureau of any omissions or errors. Your additional comments or requests for further information are also solicited.

John C Villforth

John C. Villforth
Director
Bureau of Radiological Health

# PREFACE

The Radiation Control for Health and Safety Act of 1968 authorizes the Secretary of Health, Education, and Welfare to conduct studies relating to electronic product radiation. This report presents the results of one such study which investigated the Federal control of health hazards from electronic product radiation and other types of ionizing radiation, including control of hazards from radioactive materials other than those regulated under the Atomic Energy Act of 1954. The two areas of concern were: (1) the control of health hazards to the public based on statutory authority to control radiation, and (2) the control of health hazards to Federal employees and the public from electronic products and certain radioactive materials used by the Federal government.

No attempt was made during this project to evaluate potential hazards or the adequacy of existing control programs in individual agencies, although some followup technical assistance has been provided upon request.

The information contained herein was obtained during the period from June to October 1969 and reflects the status of Federal control at that time.

Robert L. Elder

Robert L. Elder, Sc.D.
Director
Division of Electronic Products

## TABLE OF CONTENTS

Page

FOREWORD . . . . . . . . . . . . . . . . . . . . . . . . . . . iii

PREFACE . . . . . . . . . . . . . . . . . . . . . . . . . . . v

ABSTRACT . . . . . . . . . . . . . . . . . . . . . . . . . . . ix

INTRODUCTION . . . . . . . . . . . . . . . . . . . . . . . . . 1

SUMMARY AND DISCUSSION OF REPLIES TO QUESTIONNAIRE . . . . 3

CONCLUSIONS . . . . . . . . . . . . . . . . . . . . . . . . . 14

APPENDIX 1. Text of Sec. 357, PL 90-602 . . . . . . . . . . 1-1
APPENDIX 2. Solicitation of Information . . . . . . . . . . 2-1
APPENDIX 3. Replies to Question 1 . . . . . . . . . . . . 3-1
APPENDIX 4. Replies to Question 2 . . . . . . . . . . . . 4-1
APPENDIX 5. Replies to Question 3 . . . . . . . . . . . . 5-1
APPENDIX 6. Replies to Question 4 . . . . . . . . . . . . 6-1
APPENDIX 7. Replies to Question 5 . . . . . . . . . . . . 7-1
APPENDIX 8. Replies to Question 6 . . . . . . . . . . . . 8-1
APPENDIX 9. Replies to Question 7 . . . . . . . . . . . . 9-1
APPENDIX 10. Replies to Question 8 . . . . . . . . . . . . 10-1
APPENDIX 11. Replies to Question 9 . . . . . . . . . . . . 11-1

# ABSTRACT

This report documents the results of a survey which was performed during the period from June to October 1969 to investigate the various facets of Federal radiation control. The items investigated included statutory control authority, control programs and procedures, and the quantities and various types of radiation-emitting electronic products and radioactive materials used by the Federal government. Thirty-three selected departments and agencies were asked to answer specific questions relating to their programs for controlling radiation from electronic products and radioactive materials. Their responses are summarized and discussed.

BLANK PAGE

# PRESENT FEDERAL CONTROL OF HEALTH HAZARDS FROM ELECTRONIC PRODUCT RADIATION AND OTHER TYPES OF IONIZING RADIATION

## INTRODUCTION

The Radiation Control for Health and Safety Act of 1968, Public Law 90-602, amends the Public Health Service Act "to provide for the protection of the public health from radiation emissions from electronic products". Section 357 of Public Law 90-602 directs the Secretary of Health, Education, and Welfare to conduct certain studies and report to Congress on the results of these studies.* This report is of one aspect of the studies, namely present Federal control of health hazards from electronic product radiation and other types of ionizing radiation, including control of health hazards from radioactive materials other than materials regulated under the Atomic Energy Act of 1954.

Two general areas of concern relating to Federal control have been examined: (1) control of health hazards to the general public based on statutory authority to control radiation, and (2) control of health hazards to Federal employees and the public from electronic products and certain radioactive materials used by the Federal government. The study is of the nature of a survey of various facets of radiation control, including statutory control authority, control programs and procedures, and estimates of the quantities of various types of electronic products and radioactive materials used by the Federal government. No attempt was made to evaluate potential hazards of the adequacy of existing control programs in individual agencies, although some followup technical assistance has been provided upon request.

The study was conducted by directing specific questions to 33 selected departments and agencies following an initial invitation to these departments and agencies from the Secretary of Health, Education, and Welfare asking for their participation in the study.** Table 1 is a list of the participating agencies.

The 9 questions asked for specific information in the following areas:

1. Statutory responsibility or authority for the control of radiation health hazards.

2. Regulations, standards, or directives promulgated to control radiation health hazards to the public and to agency personnel and contractors.

3. Enforcement procedures for any regulations, standards, or directives.

4. Control procedures other than regulations, standards, or directives.

---

* See Appendix 1 for full test of Section 357, PL 90-602

**See Appendix 2 for details.

5. Procurement specifications which include control of radiation.

6. Control of the disposition of potentially hazardous electronic products and radioactive materials.

7. Estimates of the quantities of various electronic products and certain radioactive materials used by the agency and estimates of the number of personnel potentially exposed.

8. Known overexposures to personnel.

9. Additional measures needed to insure uniform and effective control of radiation health hazards.

Table 1

Participating Federal Departments and Agencies

Department of State
Department of the Treasury
Department of the Army
Department of the Navy
Department of the Air Force
Department of Justice
Post Office Department
Department of Agriculture
Department of the Interior
Department of Commerce
Department of Labor
Department of Housing and Urban Development
Department of Transportation
Department of Health, Education, and Welfare
United States Atomic Energy Commission
Agency for International Development
Civil Aeronautics Board
District of Columbia Government
Federal Communications Commission
General Accounting Office
Interstate Commerce Commission
Library of Congress
National Aeronautics and Space Administration
General Services Administration
Peace Corps
Government Printing Office
Smithsonian Institution
Tennessee Valley Authority
Selective Service System
United States Arms Control and Disarmament Agency
Civil Service Commission
United States Information Agency
Veterans Administration

A listing of the types of radiation and typical products which emit these types of radiation with which this study was concerned was included in the questionnaire. A summary and discussion of the responses to each question follows in the next section. Detailed replies to each question from each agency may be found in Appendices 3-11. It should be noted that this information was obtained during the period of June to October 1969 and reflects the status of Federal control at that time.

## SUMMARY AND DISCUSSION OF REPLIES TO QUESTIONNAIRE

The detailed replies to each of the 9 questions, as provided by the 33 Federal departments and agencies queried, may be found in Appendices 3-11. The following is a summary of the information submitted.

QUESTION 1. Does your agency have any statutory responsibility or authority for the control of health hazards from the types of radiation indicated in Attachment I?

If affirmative, please describe briefly the responsibility or authority, the types of radiation to which it applies, and provide a copy of the applicable statute(s) or reference to the statute(s).

Direct statutory authority or responsibility for control of health hazards to the general public from the types of radiation included in this study has been identified within the following agencies to the extent noted:

1. Department of Transportation: Control of the transportation of hazardous materials, limited to radioactive materials and does not include electronic products. (Department of Transportation Act, 49 U.S.C. 1647.)

2. Department of Labor: Control of radiation hazards to employees of certain Federal contractors (Walsh-Healey and McNamara-O'Hara Acts) and employees in certain occupations (Longshoremen and Harborworkers Act).

3. Department of Health, Education, and Welfare: (Environmental Control Administration, Bureau of Radiological Health): By authority of Public Law 90-602, "Radiation Control for Health and Safety Act of 1968." This law provides for control of the emission of electronic product radiation by regulations prescribing performance standards for those products determined to need such standards for the protection of the public health and safety.

   (Environmental Control Administration, Bureau of Water Hygiene): Promulgates and enforces Drinking Water Standards for potable water used by carriers subject to the Federal Quarantine Regulations. (Title 42, Chapter 1, Subchapter J, Sections 72.201-72.207.)

   (Food and Drug Administration); FDA has responsibility for the safe use of radiation in food processing and in the use of radiopharmaceuticals.

(National Institutes of Health): NIH has statutory responsibility regarding health hazards stemming from the control of purity, potency, and safety of radiopharmaceuticals of biological origin.

(Air Pollution Control Administration): Promulgates criteria for air quality by authority of Clean Air Acts. (42 USC 1857 et seq.)

4. Department of the Interior: (Bureau of Mines): Statutory responsibility exists for the control of health hazards from ionizing radiation in the mineral extractive and related industries. The area of principal concern is the atmospheric control of radon-daughters in uranium mining. Authority is contained in the Federal Metal and Non-Metallic Mine Safety Act of September 16, 1966, a regulatory Act to promote health and safety in metal and nonmetallic industries - Public Law 89-577, 89th Congress, HR-8989, September 16, 1966.

5. District of Columbia Government: Under the police powers, the Healing Arts Practice Act, the act relating to the practice of dentistry, and the License Act, authority is present to adopt regulations for the control of radiation health hazards in the District of Columbia.

Responsibility for indirect control of health hazards to the public from the types of radiation included in this study was noted for the following agencies:

1. Atomic Energy Commission: Regulations controlling exposure to licensed radioactive materials take into account the exposures to ionizing radiation from unlicensed materials and electronic products. The Commission regulations (Title 10 CFR) are not applicable to radioactive materials other than byproduct, source, or special nuclear materials regulated under the Atomic Energy Act of 1954, as amended, or to the electronic products emitting ionizing or non-ionizing radiation. However, the Commission's regulation 10 CFR Part 20 does take into account the exposures to ionizing radiation from such unlicensed materials and electronic products in the following respects as set forth in 10 CFR 20.1(b):

   "(b) The use of radioactive material or other sources of radiation not licensed by the Commission is not subject to the regulations in this part. However, it is the purpose of the regulations in this part to control the possession, use, and transfer of licensed material by any licensee in such a manner that exposure to such material and to radiation from such material, when added to exposures to unlicensed radioactive material and to other unlicensed sources of radiation in the possession of the licensee, and to radiation therefrom, does not exceed the standards of radiation protection prescribed in the regulations in this part."

The regulatory requirement for the consideration of exposures from both licensed materials and other sources of radiation was promulgated under the general rule-making authority of Sec. 161 of the Atomic Energy Act of 1954, as amended, (68 Stat. 948; 42 U.S.C. 2201). As a practical matter, this provision for consideration of radiation exposures from non-licensed material most frequently is significant in medical institutions where the technician or physician may use both X-ray equipment and licensed materials. A licensee's records of personnel exposures from all sources of radiation would be reviewed during the course of an inspection visit by a representative of the Division of Compliance.

2. Federal Communications Commission: The Commission is guided in its designated areas of responsibility and authority by the basic statutory principle of public interest, conveniences, and necessity. Accordingly, to the extent that radiofrequency devices are found, under PL 90-602, to represent a health hazard to the public, the Commission would take such findings into account in determining whether the public interest would be served by the grant of applications for Commission type approval or type acceptance of such devices.

3. Interstate Commerce Commission: In considering the application of a motor carrier for operating rights, the Commission takes into account the applicant's record of compliance with safety regulations, including those governing the transportation of hazardous materials.

4. Department of Health, Education, and Welfare: (Social Security Administration): Responsibility for administering the Medicare Program. Uses the official health agencies to determine whether hospitals and other health care units meet minimal conditions of services for participation in the medicare program. Services include the array of radiation sources found in hospital environments; in addition, electronic product radiation sources are also reviewed.

   (Community Health Service, Health Service and Mental Health Administration): Formulated conditions of participation (minimal conditions of service) for Medicare Program of SSA. Regulations and other specific requirements for health and safety include all diagnostic and therapeutic X-ray facilities and services available to medicare beneficiaries. Through its responsibilities under the Hill-Burton Act, prescribes standards for hospital construction and equipment.

5. General Services Administration: The Federal Property and Administrative Services Act of 1949, 63 Stat. 377, as amended, requires that GSA coordinate Federal Standardization Documents with agencies that do have statutory responsibility affecting product requirements. Issues the "Federal Property Management Regulations" which deal with the utilization, sale, abandonment, and destruction of personal property, including hazardous materials and electronic products.

The Federal Radiation Council, although not specifically included in this study of Federal agencies, prepares recommendations for the approval of the President for guidance of Federal agencies in their radiation protection activities. The Federal Radiation Council, however, does not issue or enforce regulations and therefore does not have any direct radiation control authority. Thus, the function of the Council is advisory and includes guidance to Federal agencies in the formulation of radiation standards.

The Council was established by Executive Order 10831 of August 14, 1959, and by section 274h of the Atomic Energy Act of 1954 as amended on September 23, 1959, (73 Stat. 690). It consists of the Secretaries of Health, Education, and Welfare; Commerce; Defense; Labor; Agriculture; and Interior; and the Chairman of the Atomic Energy Commission. The Council has submitted 5 memoranda, all dealing with ionizing radiation, which have been approved by the President. The Council has also published collections of background information relating to the development of radiation standards.

Although five Federal agencies have direct statutory authority or responsibility for the control of health hazards to the general public from the types of radiation included in this study, and five agencies have some indirect responsibility, the control is limited. Authority is restricted to certain types of radiation, occupational situations, radiation uses, or locations. No Federal agency has authority to control the health hazards to the public from the general use of certain radioactive materials, such as radium, which are not controlled by the AEC.

QUESTION 2. Has your agency promulgated any regulations, standards, directives, etc., for the control of health hazards from the types of radiation indicated in Attachment I, including the following:

a. Control of health hazards to the public?
b. Control of health hazards to agency personnel and contractors?

If affirmative, please describe briefly the regulations, standards, directives, etc., indicating the types of radiation to which they apply and provide a copy of such documents or reference to the documents.

Twelve agencies indicated that regulations, standards, or directives for the control of radiation health hazards to the public have been promulgated. The regulations, standards, or directives were issued either expressly to control health hazards to the public or were applicable to radiation control within the agency but, in part, control health hazards to the public. These agencies are the following:

Department of the Army
Department of the Navy
Department of the Air Force
Post Office Department
Department of the Interior
Department of Agriculture
Smithsonian Institution
Department of Transportation
Atomic Energy Commission
District of Columbia Government
National Aeronautics and Space Administration
Department of Health, Education, and Welfare
Department of Labor[*]

Regulations, promulgated pursuant to statutory authority, to control radiation health hazards to the public are limited in scope and applicability since the authority is limited as discussed under Question 1. Existing regulations are restricted to the control of certain types of radiation, radiation uses, occupational situations, or locations.

The following 16 agencies indicated that regulations, standards, or directives have been issued for the control of radiation health hazards to agency personnel and contractors:

Department of State
Department of the Army
Department of the Navy
Department of the Air Force
Department of Justice
Department of the Interior
Department of Agriculture
Department of Commerce
Atomic Energy Commission
District of Columbia Government
National Aeronautics and Space Administration
Department of Health, Education, and Welfare
Smithsonian Institution
Tennessee Valley Authority
Veterans Administration
Department of Transportation
Department of Labor[**]

In general, when an agency uses electronic products or radioactive materials and a potential hazard is recognized, regulations, standards, or directives have been issued to control health hazards to agency personnel and often to contractors. For many of the types of electronic product radiation included in this study, however, the potential hazards, if any, have not been defined and, thus, there is no basis for the issuance of control regulations.

---

[*] Although not reported in the questionnaire, the Department of Labor has issued regulations pertaining to the control of radiation health hazards to selected occupational groups.

[**] Although not reported in the questionnaire, the Department of Labor has issued regulations pertaining to the control of radiation health hazards to selected classes of government contractors.

QUESTION 3. How does your agency enforce the regulations, standards, directives, etc., reported in Question 2, or insure compliance with them? Briefly describe enforcement procedures, organization, and methods. If possible indicate degree of effectiveness.

Each of the departments or agencies which reported having promulgated regulations, standards, or directives indicated that enforcement procedures are in effect. These enforcement procedures vary. For protection of agency personnel, management directives implemented by some form of health and safety program are utilized. The health and safety programs are accomplished through the delegation of responsibility to line supervisors with assistance provided in the form of inspections, surveys, reviews and issuance of operating procedures manuals. The assistance is provided by a radiation safety officer, or health physics, nuclear safety, or medical personnel, and by such groups as a radiation safety committee or health and safety advisory council. Violations of rules or operating directives are dealt with directly by management or by delegation to health and safety personnel or groups.

Enforcement procedures for the protection of the public are also varied. Those agencies which have promulgated regulations pursuant to statutory authority have enforcement procedures specific to their regulations and responsibilities. As examples, these procedures may include environmental monitoring, source monitoring, manufacture performance monitoring, public hearings, stop-work orders, revocation of licenses or certification, and stop-sale directives for source items not in compliance with regulations.

QUESTION 4. What control procedures, as distinguished from regulations or standards, are employed to control health hazards to the public and to agency and contractor personnel from the types of radiation indicated in Attachment I?

Briefly describe such control procedures, the types of radiation to which they apply, and provide a copy of any documents such as procedure manuals, organizational charts, or other materials which are applicable.

Fourteen departments or agencies indicate that control procedures are in effect other than the regulations, standards, or directives. CFR Title 10 (Atomic Energy) Part 20 (Standards for Protection Against Radiation) is referenced by some agencies, mistakenly, to encompass all types of radiation when, in fact, it applies specifically only to the control of ionizing radiation through licensing of users and generally only to "byproduct, source, and special" radioactive materials. This is clearly explained in the preceding description of the indirect statutory involvement of the Atomic Energy Commission in the control of radiation sources.

The control programs and procedures of the various Federal departments and agencies vary considerably. In some instances they may amount only to supervisory warnings of caution to employees where a potential hazard is recognized. In other instances, well developed radiation control programs exist, including standards, directives, guidance, enforcement, and medical programs to detect adverse biological effects. Fortunately, in the Federal Government, the major users of radiation sources do support environmental control activities as well as health services and impose their own controls and regulations, which usually provide effective measures for prevention of injury within these agencies.

Though not acknowledged by some departments and agencies, all Federal government agencies are authorized to establish a health service program for employees as provided in Title V, Section 7901, U.S. Code. Also, Section 5 U.S. Code 7902 authorizes the head of each Federal agency to develop and support organized safety programs to reduce accidents and injuries in his agency, encourage safe practices, and eliminate work hazards and risks. Also referenced as delegating responsibility for safeguarding health and safety of employees and the public are 16 U.S. Code 742a et seq. and the Tort Claims Act (28 U.S. Code 2401 et seq.).

Public Law 658, August 8, 1946, authorizes the heads of departments and agencies to establish "health service programs" for the purpose of promoting and maintaining the physical and mental fitness of employees of the Federal government. The authority includes establishment of preventive programs related to health. The authority is delegated to the department or agency head "within the limits of the appropriations made available therefor." Understandably, the appropriations available for competing programs limit the implementation of viable comprehensive health service programs within the Federal government. Frequently, even where health service programs are established, prevention programs are not included.

Though conjectural, it is probable that many human effects, though manifested, go unrecognized as related to their cause (or causes) since most human degenerative changes are not well understood. Also, many recognized chronic diseases are not understood with respect to their etiology. The incidence of exposure of individuals to the various environmental radiations, either separately or collectively, is not generally known nor are the possible related human effects. However, control efforts should not demand definitive knowledge of cause and effect relationships before requiring conservative limitations to human exposures. It is ridiculous when human exposures occur and demonstrable effects are recognized (and even very demanding reparation costs are encumbered), to operate in any manner without positive and adequate control of human exposures.

QUESTION 5. Does your agency have specifications for the procurement of items, which may emit the types of radiation indicated in Attachment I, which include control of these types of radiation?

If affirmative, please describe briefly the specifications, the types of items to which they apply, and provide a copy of applicable specification documents.

QUESTION 6. Does your agency have any regulations, standards, directives, specifications, or other methods pertaining to control of the disposition of used or surplus items which may emit the types of radiation indicated in Attachment I?

If affirmative, please describe briefly such documents or control methods and provide a copy of applicable documents.

Eight departments or agencies report that procurement of radiation source item is controlled. Seven departments or agencies report that disposition of radiation source items is controlled. Generally, the controls referred to are with reference to ionizing radiation source items. Though not generally acknowledged, all Federal installations are subject to the requirements of the "Federal Property Management Regulations" (FPMR), issued by the General Services Administration, which deals with utilization, sale, abandonment, and destruction of personal property. It is through the FPMR that both procurement and disposal controls can and should be strengthened to minimize hazards to employees as well as preventing the use of hazardous items by unsuspecting public recipients of disposed items.

QUESTION 7. Does your agency or your contractors use or possess any electronic product or radioactive material which may emit the types of radiation indicated in Attachment I?

If affirmative, please provide the following:

(a) An estimate of the number of each type of electronic product or radioactive source.
(b) An estimate of the number of agency or contractor personnel who potentially may be exposed to radiation from each type of electronic product or radioactive source.
(c) An indication of whether or not members of the general public, i.e., persons not under the control of your agency or contractor, potentially may be exposed to radiation from each type of electronic product or radioactive source.

Twenty-seven departments or agencies furnished an inventory of the electronic product radiation sources that are under their administrative control. Generally, this did not include items used by their contractors which was deemed inaccessible information. These inventories, though admitted to be incomplete, provide rough estimates of the extent and distribution of use of electronic products in use within the Federal government. Electronic products of every category are in use, some in large numbers, i.e., tens of thousands. A total of more than 200,000 radiation source devices were identified. Also a relatively large quantity of material sources of ionizing radiation not regulated under the Atomic Energy Act of 1954 were identified by these 27 agencies. There is every indication that modern technology will continue to provide new and ever increasing numbers of both of these types of radiation sources. See summary, Table 2.

QUESTION 8. Have there ever been any known overexposures to agency or contractor personnel from the types of radiation indicated in Attachment I?

If affirmative, please briefly describe such occurrences and indicate where additional details can be obtained.

Ten departments or agencies report occurrences of overexposures of personnel to radiation of some kind. Most of these are identified as occasional overexposure measurements by personal dosimeters, such as film badges, which exceed the guide limits for ionizing radiation exposure. Acute burns from lasers, microwave generators, X-ray diffraction units, and ultraviolet light sources were reported. The occurrence of lung cancer attributed to chronic exposures to the ionizing radiation from radon and radon daughters was also cited. It is surmised that most acute effects have been recognized and reported. Chronic effects, if any, are more subtle, more difficult to relate to exposures, and more difficult to recognize. Also, since many of the radiation sources are relatively new, the occurrence of repetitive exposures perhaps has not been of sufficient duration to cause any demonstrable effects. In the case of sonic effects, the magnitude and/or duration of exposures from electronic products may not yet be recognized as contributing to the chronic effects now observed.

Though 19 agencies reported that they had over 5,000 sonic radiation sources, the existence of exposure control programs or the recognition of injuries was not evident and no injuries were reported due to sonic exposures. However, the Bureau of Employee's Compensation (Department of Labor) reports that 213 scheduled awards were granted to permanently injured Federal employees during 1966 for loss of hearing. These new awards totaled $917,576 which represents 10.8% of all scheduled awards granted during the year. In addition are the costs which precede the scheduled awards. The annual cumulative cost is much greater. The total cost to society due to incapacity of the individuals is greater still. Though these injuries are now relatable to past exposures to sonic sources they may now or will in the future be relatable to exposures to electronic product sonic sources. This is but one notable

| | A.1 | A.2 | B.1 | B.2 | B.3 | B.4 | B.5 | B.6.A | B.6.B | C.1 | C.2 | C.3 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Radium, Other Natural Sources & Accelerator Produced Radionuclides | Ionizing Radiation Producing Devices | Ultraviolet | Visible | Infrared | Microwave | Radio & Low Frequency | Lasers | Masers | Infrasonic | Sonic | Ultrasonic | Total A.2-C.3 |
| State | - | 62 | 11 | - | - | 14 | 150 | - | - | - | - | 5 | 242 |
| Treasury | - | 12 | 21 | - | 11 | - | - | 2 | - | - | - | 5 | 51 |
| Army | * | 4,119 | 169 | 4,500 | 5,500 | 19,145 | 6,060 | 630 | 3 | ? | ? | 767 | 40,893 |
| Navy | 340 | 5,994 | 204 | 9,575 | 9,365 | 4,174 | 1,005 | 328 | 495 | - | 600 | 164 | >31,904 |
| Air Force | x+ | 35,509 | 1,443 | 1,043 | 30 | 3,466 | 28,879 | 210 | - | x | > 1,000 | 1,058 | >72,638 |
| Justice | - | >303 | 48 | - | 72 | 27 | 360 | - | - | - | x | 33 | >843 |
| Post Office | x | x | >7 | >15 | >1 | x | > 13 | 1 | - | - | - | 4 | > 41 |
| Interior | 59 | 939 | 243 | 475 | 259 | 240 | 1,520 | 59 | - | 1 | 7 | 96 | 3,839 |
| Agriculture | 170 | 48 | x | x | x | x | x | x | - | - | - | x | >48 |
| Commerce | 222 | 471 | 181 | 74 | 159 | 287 | 346 | 84 | 3 | 9 | 83 | 86 | 1,763 |
| Labor | | | None | | | | | | | | | | |
| HUD | | | None | | | | | | | | | | |
| Transportation | x | > 3,953 | 4 | - | 183 | >1,527 | >11,550 | - | - | 5 | 1 | 36 | >17,259 |
| HEW | 3,356 | 1,702 | 3,722 | 1,161 | >1,132 | 141 | 416 | 35 | - | 2 | >176 | 286 | > 8,773 |
| AEC | | 210 | Compiling Inventory | | | | | | | | | | >210 |
| AID | | | No Way To Estimate | | | | | | | | | | |
| CAB | | 1 | | | | | | | | | | | 1 |
| D.C. Government | | 115 | | | | | | | | | | | >115 |
| FCC | - | 120 | - | - | - | 13 | 244 | - | - | 1 | x | 1 | > 379 |
| GAO | | 1 | | 1 | | | | | | | 4 | | 6 |
| ICC | - | 3 | - | - | 2 | - | x | - | - | - | - | - | 5 |
| Library of Congress | | | None | | | | | | | | | | |
| NASA | >271 | >1,195 | 549 | >275 | >1,110 | >637 | >2,068 | 366 | 4 | 56 | 24 | >145 | >6,429 |
| Peace Corps | - | 6 | | | | | | | | | | | 6 |
| GSA | | 2,705 | 8 | | x | x | x | | | | | 17 | >2,730 |
| GPO | 120 | 12 | 70 | 40 | 500 | - | - | - | - | - | 250 | - | 872 |
| Smithsonian | 4 | 27 | 19 | 17 | 15 | 20 | 11 | 3 | 1 | | 1 | 7 | 121 |
| TVA | 77 | 217 | 12 | - | 41 | 9 | 40 | - | - | 7 | 2 | 14 | 342 |
| Selective Service | None | | | | | | | | | | | | |
| Arms Control | | 2 | | | | | | | | | | | 2 |
| Civil Service | | 4 | | | | | | | | | | | 4 |
| USIA | - | 86 | - | 7 | - | - | 102 | - | - | - | - | 1 | 196 |
| VA | 990 | 11,049' | 1,539 | 199 | 1,207 | 320 | 654 | 21 | - | - | - | 587 | 15,576 |
| TOTAL | >5,607* | >68,865 | >8,250 | >17,382 | >19,587 | >30,020 | >53,068 | >1,739 | 506 | >81 | >2,118 | >3,312 | >204,958 |

x - In use - No estimate of number.

* - Several hundred thousand sources including several hundred grams of radium and several hundred curies of accelerator-produced radionuclides.

' - Includes 7,776 B&W TV.

+ - 0.1 Ci Radium
0.16 Ci Cobalt 57
0.0003 Ci Sodium 22
0.025 Ci Polonium 208-209

Table 2. Summary of Use, by Federal Agencies, of Radiation Producing Electronic Products and Other Radiation Sources with Distribution According to Type of Radiation Produced.

example of the ineffectiveness that prevails within control programs in associating the environmental etiologic agents which are wholly or partially responsible for alterations in human capabilities which do occur.

QUESTION 9. What additional measures do you feel are necessary or desirable to insure uniform and effective control of health hazards from electronic product radiation and other types of ionizing radiation, as indicated in Attachment I?

Twenty-four departments or agencies offered recommendations or comments relative to measures necessary or desirable to insure uniform and effective control of health hazards from electronic products and other types of ionizing radiations. These recommendations are summarized in Appendix 11 of this report. The consensus of replies, verbally as well as in the reports, confirmed support to the intent of the provisions of PL 90-602 and recognized the fundamental value of the promulgation of performance standards for electronic products in the control of electronic product radiations. Some suggested that further explicit requirements should be made for the manufacturer of radiation producing equipment. This included:

1. To furnish the user with radiation level emitted and amount of protection required.
2. To label equipment with a warning that radiation emitted may be hazardous to the user or general public since people (users) may be completely unaware of the potential hazards.
3. To advise the user to read the operating instructions and the hazard analysis report provided before operating the device.

Additional measures suggested included:

1. Within the Federal government standard Federal specifications should be formulated for purchase of electronic product radiation source devices.
2. Uniform health and safety regulations, standards, directions, and operating procedures should be developed and promulgated to control health hazards from electronic product radiations.
3. Development and publication of material relating to health hazards of electronic product radiations.
4. Development and conduct of simplified, low-cost training courses to specifically relate the radiation sources with health hazards and to assure uniform and meaningful monitoring of the hazards.
5. Development of monitoring instrumentation where needed.
6. Promote conduct of objective research to resolve any uncertainties relative to human effects which result from exposure to the various types of radiation.

## CONCLUSIONS

1. Federal statutory authority and responsibility for the control of health hazards to the public from electronic product radiation and certain types of radioactive material is limited to specified occupational situations, radiation uses, locations, or types of radiation. No Federal agency has authority to control the health hazards to the public from the general use of certain radioactive materials, such as radium, which are not controlled by the Atomic Energy Commission.

2. The Federal government is a major user of electronic products which may be potentially hazardous, and many thousands of employees are potentially exposed. The general public may also be exposed. The extent and magnitude of exposure of people, with the exception of that from ionizing radiation, is generally unknown.

3. The radiation control programs and procedures of the various Federal departments and agencies vary considerably and range from inadequate to comprehensive and effective. Many agencies are not staffed to recognize, identify, or adequately control electronic product radiation hazards.

4. The recognition, acceptance and use of existing guides and standards varies throughout the Federal government. The need for uniform exposure, measurement, and use standards, procedures and guides for all of the radiations encountered is generally recognized and desired.

5. Technical assistance is not readily available to all Federal departments and agencies to assist in the timely solution of their radiological health problems or to provide objective evaluation of their control programs. A single source of training information is needed which can serve as the clearinghouse of all radiological information for use of Federal activities.

6. Federal government specifications for electronic products do not always contain desirable requirements for the protection of health of users or of the public.

7. Federal requirements for disposal of electronic products do not always provide adequate protection of the public.

8. The excellent control program under the Atomic Energy Act (10 CFR Part 20) has an incidental beneficial effect on the control of non-AEC controlled radioactive materials and to a lesser degree on the control of machine generated ionizing radiation. The need for a comparable Federal government-wide electronic product and radioactive materials control program is evident.

# APPENDICES

BLANK PAGE

## APPENDIX 1

## SECTION 357, PUBLIC LAW 90-602

### "STUDIES BY THE SECRETARY

"Sec. 357. (a) The Secretary shall conduct the following studies, and shall make a report or reports of the results of such studies to the Congress on or before January 1, 1970, and from time to time thereafter as he may find necessary, together with such recommendations for legislation as he may deem appropriate:

"(1) A study of present State and Federal control of health hazards from electronic product radiation and other types of ionizing radiation, which study shall include, but not be limited to--

"(A) control of health hazards from radioactive materials other than materials regulated under the Atomic Energy Act of 1954;

"(B) any gaps and inconsistencies in present controls;

"(C) the need for controlling the sale of certain used electronic products, particularly antiquated X-ray equipment, without upgrading such products to meet the standards for new products or separate standards for used products;

"(D) measures to assure consistent and effective control of the aforementioned health hazards;

"(E) measures to strengthen radiological health programs of State governments; and

"(F) the feasibility of authorizing the Secretary to enter into arrangements with individual States or groups of States to define their respective functions and responsibilities for the control of electronic product radiation and other ionizing radiation;

"(2) A study to determine the necessity for the development of standards for the use of nonmedical electronic products for commercial and industrial purposes; and

"(3) A study of the development of practicable procedures for the detection and measurement of electronic product radiation which may be emitted from electronic products manufactured or imported prior to the effective date of any applicable standard established pursuant to this subpart.

"(b) In carrying out these studies, the Secretary shall invite the participation of other Federal departments and agencies having related responsibilities and interests, State governments--particularly those of States which regulate radioactive materials under section 274 of the Atomic Energy Act of 1954, as amended, and interested professional, labor, and industrial organizations. Upon request from congressional committees interested in these studies, the Secretary shall keep these committees currently informed as to the progress of the studies and shall permit the committees to send observers to meetings of the study groups.

"(c) The Secretary or his designee shall organize the studies and the participation of the invited participants as he deems best. Any dissent from the findings and recommendations of the Secretary shall be included in the report if so requested by the dissenter."

# APPENDIX 2

## SOLICITATION OF INFORMATION

On May 16, 1969, each Federal department and selected agencies, as shown in the following table, were invited by letter from the Secretary of Health, Education, and Welfare to assist in compiling information for this study. Upon receipt of the reply to the Secretary's invitation, a letter with attachments was sent to each of the persons designated by the department or agency to be responsible for providing the requested information. Personal visits were held with most of the designated persons to discuss the purpose of the study and the information which was requested.

The cooperation of the invited participants was, for the most part, excellent. Much time and effort was expended within the departments and agencies in obtaining and compiling the detailed information which was submitted. The spirit of interagency cooperation and the sincere efforts of the participants are appreciated.

### PARTICIPATING FEDERAL DEPARTMENTS AND AGENCIES

Department of State
Department of the Treasury
Department of the Army
Department of the Navy
Department of the Air Force
Department of Justice
Post Office Department
Department of the Interior
Department of Agriculture
Department of Commerce
Department of Labor
Department of Housing and Urban Development
Department of Transportation
Department of Health, Education, and Welfare
United States Atomic Energy Commission
Agency for International Development
Civil Aeronautics Board
District of Columbia Government
Federal Communications Commission
General Accounting Office
Interstate Commerce Commission
Library of Congress
National Aeronautics and Space Administration
Peace Corps
General Services Administration
Government Printing Office
Smithsonian Institution
Tennessee Valley Authority
Selective Service System
United States Arms Control and Disarmament Agency
Civil Service Commission
United States Information Agency
Veterans Administration

## Exhibit A

## May 16, 1969, Letter from Secretary Finch to Federal Departments and Agencies

"Dear ________________,

"Under the recently enacted Radiation Control for Health and Safety Act of 1968, Public Law 90-602 (copy enclosed), I have been assigned the responsibility to conduct a series of studies to: (1) determine the present Federal control of health hazards from electronic product radiation and other types of ionizing radiation, (2) determine the necessity for the development of related standards, and (3) develop practicable detection and measurement procedures for this radiation. A report of these studies must be presented to Congress by January 1, 1970. These studies will be followed by a series of annual reports as dictated in section 360D of the aforementioned bill.

"Specific types of information which we are including in the report to Congress are: (1) radiation safety standards, guides, and procedures which are applied to sources of radiation used by your agency as well as sources of radiation used outside your agency over which you exercise control (e.g., contractors), (2) radiation safety activities pursued by your agency and/or related procedures established by your agency including programs to assure compliance with radiation safety standards, guides, or procedures, and (3) number and types of sources of electronic product radiation used by your agency as well as other types of radiation sources which fall outside the regulatory jurisdiction of the Atomic Energy Commission.

"In order to effectively execute this responsibility and as per Paragraph (b), Section 357, P.L. 90-602, I am inviting your cooperation and participation in these studies. I have assigned the responsibility for assembling the information and for follow-up on any specific questions to the Bureau of Radiological Health in the Environmental Control Administration, Consumer Protection and Environmental Health Service. I am therefore requesting that you designate those individuals whom we might contact to procure the information described above. The names of persons so designated should be sent to:

Dr. Robertson J. Augustine
Bureau of Radiological Health
12720 Twinbrook Parkway
Rockville, Maryland 20852

"We will provide you with copies of our observations and conclusions before we submit the report to Congress.

Sincerely,

Secretary"

Enclosure

## Exhibit B

## Letter and Attachments Requesting Specific Information

"Dear _____________:

"In accordance with the Radiation Control for Health and Safety Act of 1968, Public Law 90-602, Section 357, we are conducting a study of present Federal control of health hazards from electronic product radiation and other types of ionizing radiation. It is our understanding that you have been designated to participate in this study and to provide certain information regarding your agency,

"We have prepared a listing of the types of radiation and typical products which emit these types of radiation with which this study is concerned. This listing is referred to as the Scope and is shown in Attachment I. Attachment, II, Information Requested, is a listing of nine questions concerning your agency's control of health hazards from these types of radiation.

"In the near future, we will be contacting you to arrange a personal visit in order that we may discuss the study and answer any questions you may have. To meet the time schedule for submitting the Secretary's report to Congress, we hope that information from all participating agencies can be received within thirty days after our personal visit with you.

"We appreciate your consideration of this request and look forward to your participation in this study.

Sincerely yours,

R. J. Augustine, Ph.D.
Division of Environmental Radiation
Bureau of Radiological Health
Telephone: 496-8281 or
Code 14-68281"

Enclosures:
Attachment I
Attachment II
PL 90-602

SCOPE: Study encompasses the following types of radiation:

A. Ionizing electromagnetic and particulate radiation from the following:

1. Radioactive materials other than materials regulated under the Atomic Energy Act of 1954, such as:

   (a) radium
   (b) radon and daughters
   (c) other "natural" radionuclides
   (d) accelerator produced radionuclides
   (e) other

2. Electronic products, such as:

   (a) X-ray machines
   (b) television receivers
   (c) neutron generators
   (d) accelerators
   (e) klystron tubes
   (f) electron microscopes
   (g) X-ray diffraction instruments
   (h) electron beam welders
   (i) other

B. Non-ionizing electromagnetic radiation, such as the following:

1. Ultraviolet, from:

   (a) biochemical and medical analyzers
   (b) cosmetic and therapeutic lamps
   (c) sanitizing and sterilizing devices
   (d) other

2. Visible, from:

   (a) white light devices
   (b) other

3. Infrared, from:

   (a) alarm systems
   (b) dryers, ovens, and heaters
   (c) other

4. Microwave, from:

   (a) alarm systems
   (b) diathermy units
   (c) dryers, ovens, and heaters
   (d) medico-biological heaters

   - (e) microwave power generating devices
   - (f) radar devices
   - (g) remote control devices
   - (h) signal generators
   - (i) other

5. Radio and low frequency, from:

   - (a) cauterizers
   - (b) diathermy units
   - (c) power generation and transmission equipment
   - (d) signal generators
   - (e) other

6. Coherent electromagnetic radiation produced by stimulated emission, from:

   - (a) lasers
     - (1) art-form, experimental and educational devices
     - (2) biomedical analyzers
     - (3) cauterizing, burning, and welding devices
     - (4) cutting and drilling devices
     - (5) communications transmitters
     - (6) range finding devices
     - (7) other
   - (b) masers
     - (1) communication transmitters
     - (2) other

C. Infrasonic, sonic, and ultrasonic vibrations, resulting from operation of an electronic circuit, such as:

1. Infrasonic, from:

   - (a) vibrators
   - (b) other

2. Sonic, from:

   - (a) electronic oscillators
   - (b) other

3. Ultrasonic, from:

   - (a) cauterizers
   - (b) cell and tissue disintegrators
   - (c) cleaners
   - (d) diagnostic and nondestructive testing equipment
   - (e) ranging and detection equipment
   - (f) other

Attachment II

## INFORMATION REQUESTED

1. Does your agency have any statutory responsibility or authority for the control of health hazards from the types of radiation indicated in Attachment I?

   If affirmative, please describe briefly the responsibility or authority, the types of radiation to which it applies, and provide a copy of the applicable statute(s) or reference to the statute(s).

2. Has your agency promulgated any regulations, standards, directives, etc., for the control of health hazards from the types of radiation indicated in Attachment I, including the following:

   (a) Control of health hazards to the public?
   (b) Control of health hazards to agency personnel and contractors?

   If affirmative, please describe briefly the regulations, standards, directives, etc., indicating the types of radiation to which they apply and provide a copy of such documents or reference to the documents.

3. How does your agency enforce the regulations, standards, directives, etc., reported in Question 2, or insure compliance with them?

   Briefly describe enforcement procedures, organization, and methods, If possible indicate degree of effectiveness.

4. What control procedures, as distinguished from regulations or standards, are employed to control health hazards to the public and to agency and contractor personnel from the types of radiation indicated in Attachment I?

   Briefly describe such control procedures, the types of radiation to which they apply, and provide a copy of any documents such as procedure manuals, organizational charts, or other materials which are applicable.

5. Does your agency have specifications for the procurement of items, which may emit the types of radiation indicated in Attachment I, which include control of these types of radiation?

   If affirmative, please describe briefly the specifications, the types of items to which they apply, and provide a copy of applicable specification documents.

6. Does your agency have any regulations, standards, directives, specifications, or other methods pertaining to control of the disposition of used or surplus items which may emit the types of radiation indicated in Attachment I?

   If affirmative, please describe briefly such documents or control methods and provide a copy of applicable documents.

7. Does your agency or your contractors use or possess any electronic product or radioactive material which may emit the types of radiation indicated in Attachment I?

   If affirmative, please provide the following:

   (a) An estimate of the number of each type of electronic product or radioactive source.

   (b) An estimate of the number of agency or contractor personnel who potentially may be exposed to radiation from each type of electronic product or radioactive source.

   (c) An indication of whether or not members of the general public, i.e., persons not under the control of your agency or contractor, potentially may be exposed to radiation from each type of electronic product or radioactive source.

8. Have there ever been any known overexposures to agency or contractor personnel from the types of radiation indicated in Attachment I?

   If affirmative, please briefly describe such occurrences and indicate where additional details can be obtained.

9. What additional measures do you feel are necessary or desirable to insure uniform and effective control of health hazards from electronic product radiation and other types of ionizing radiation, as indicated in Attachment I?

BLANK PAGE

# APPENDIX 3

## REPLIES TO QUESTION 1

The following is a summary of the replies to Question 1 as provided by the departments and agencies queried. The detailed materials and supporting documents referenced in the replies are on file in the Bureau of Radiological Health.

> QUESTION 1. Does your agency have any statutory responsibility or authority for the control of health hazards from the types of radiation indicated in Attachment I?
>
> If affirmative, please describe briefly the responsibility or authority, the types of radiation to which it applies, and provide a copy of the applicable statute(s) or reference to the statute(s).

State Department - None. The Department, in the exercise of its foreign affairs functions, has participated in the negotiation and execution of various international agreements for the peaceful use of radioactive energy, which agreements contain provisions concerning public health and safety; responsibility for implementation of these agreements is not with the Department of State.

Treasury Department (Mint) - Voluntary responsibility only. The Bureau of Customs does not have any statutory responsibility or authority for the control of health hazards from the types of radiation indicated in Attachment I. The Bureau of Customs is involved in one program which may or may not be reportable here and is presented for your consideration. This relates to our program to control importation of products which produce a type of ionizing radiation which may be a health hazard. We are on the lookout for articles containing strontium 90, particularly watches and clocks with luminescent faces, dials or hands. Bureau Circular No. X-351, dated February 1, 1960, containing our instructions to the field in this matter is attached.

Department of the Army - The Surgeon General, Department of the Army, under the general staff supervision of the Deputy Chief of Staff for Personnel, has the responsibility for management of health services for the Army and also establishes health standards applicable to personnel of the Army. (Authority: Paragraph 2-36a(1), Army Regulation 10-5 and Public Law 658, 79th Congress.)

Department of the Navy - There is no specific authority or responsibility for such matters placed in the Navy Department by the United States Code. 10 USC 7205, however, does authorize SECNAV to make expenditures to promote safety and occupational health of the members. The section reads as follows:

Sec. 7205. Promotion of health and prevention of accidents

(a) The Secretary of the Navy may make such expenditures as he considers appropriate to prevent accidents and to promote the safety and occupational health of--

(1) members of the naval service on active duty;
(2) civilian officers and employees of the Department of the Navy;
(3) members of the Coast Guard when it is operating as a service in the Navy; and
(4) members of the Environmental Science Services Administration serving with the Navy.

The expenditures may include payments for clothing, equipment, and other materials necessary for the purposes of this section. Any appropriation available for the activities in which the personnel are engaged shall be available for these purposes.

(b) The Secretary, to the extent he considers proper, may delegate the authority conferred by this section to any person in the Department of the Navy, with or without the authority to make successive redelegations.

Although not purely statutory in nature, the following provisions of U.S. Navy Regulations, 1948, concerning safety are listed inasmuch as such Presidential regulations have the force and effect of law:

a. Article 0406
b. Article 0430.7
c. Article 0445.4
d. Article 0712
e. Article 0748

Department of the Air Force - The Department of the Air Force does not, in general, carry out its programs in consonance with statutory authority, but rather by prescribing regulations. Section 8012, Title 10, U.S. Code, authorizes the Secretary of the Air Force to conduct all affairs of the Department of the Air Force and to "prescribe regulations to carry out his functions, powers, and duties under this title." Under Section 8067, Title 10, U.S. Code, the Medical functions of the Air Force are described in general terms.

Air Force Regulation 20-28, 21 October 1963 (as changed 31 March 1965), states the mission, composition, and functions of the Medical Service, USAF, which furnishes the professional medical and allied services referred to in the Air Force Organizational Act (Sec. 8067, Title 10, U.S. Code).

The USAF Medical Service, under the provisions of AFR 20-28, develops, implements, and supervises an aerospace medical program which includes: (1) providing occupational medical support, bioenvironmental engineering, health physics, and health education for all USAF systems, and (2) establishing criteria for protection against adverse exposures to health hazards to Air Force military and civilian personnel.

The USAF has no statutory responsibility for the control of health hazards from these types (A.1) of radiation.

This agency has no statutory responsibility for control of health hazards associated with use of electronic products covered under Item 2a through 2h. The laws, directives, and regulations governing the creation of the USAF and its medical service provide the necessary authority.

The USAF has no statutory responsibility for control of health hazards from this type (B.1) of radiation.

The Air Force does not use statutory authority for control of health hazards but rather uses prescribing regulations. (B.2, B.5, B.6, C.1, C.2, and C.3.)

The USAF has no statutory responsibility for control of health hazards from this type (B.3) of radiation.

The USAF has no statutory authority for control of health hazards from microwave radiation (B.4).

Justice Department - Our Office of Legal Counsel advises us there does not appear to be any statute conferring responsibility or authority on the Attorney General with respect to the control of health hazards from radiation.

Department of Interior - Within the Department of Interior, apparently no organizational unit has specific statutory responsibility or authority for the control of health hazards from the subject types of radiation. Most responses were definite on this point. However, the Bureau of Sport Fisheries and Wildlife Reclamation, and the Bureau of Commercial Fisheries qualified their negative answers with the following comments: Bureau of Sport Fisheries and Wildlife - "None, except as may be implied indirectly in our general authorizing legislation."

(Bureau of Reclamation) - "To our knowledge, Reclamation does not have any statutory responsibility or authority relating specifically to the control of health hazards from the subject types of radiation. However, Section 5 U.S.C. 7902 requires the head of each Federal agency to develop and support organized safety promotion to reduce accidents and injuries in his agency, encourage safe practices, and eliminate work hazards and risks. Also, Section 10 of the Reclamation Act authorizes the Secretary of the Interior to perform any and all acts and to make such rules and regulations as necessary to carry out the provisions of the Act. G.O. 939 specifically refers to accident prevention responsibilities of Reclamation. Under current policy, Reclamation's responsibility for health and safety includes provision for control of hazards from the types of radiation under consideration."

(Bureau of Commercial Fisheries) - "The Bureau of Commercial Fisheries has no specific statutory responsibility for the control of health hazards from the types of radiation indicated in Attachment I. However, the Bureau has general responsibility of safeguarding the health of employees and the public under 16 U.S.C. 742a et seq. and the Tort Claims Act (28 U.S.C. 2401 et seq.). Where applicable, such as in the Bureau's Division of Food Science laboratories concerned with irradiator used for fishery products, persons are selected, trained, and licensed by the Atomic Energy Commission to handle radiation equipment. Radiation materials also are required to be licensed. To ensure against health hazards from radiation, the Bureau has: 1) adhered to the Code of Federal Regulations, Title 10 (Atomic Energy), Part 20 (Standards for Protection against Radiation), and 2) where necessary, developed standards to be followed for personnel safety to meet various specialized situations. The Bureau does not believe it is either necessary or desirable to obtain statutory responsibility at this time relating to radiation and health hazards in view of Code of Federal Regulations, Title 10."

The Federal Water Pollution Control Administration similarly does not have statutory responsibility or authority for regulating and controlling radiation from electronic products. However, Section 10 of the Water Pollution Control Act (Public Law 84-660) does provide for the "establishment of water quality criteria applicable to interstate waters or portions thereof." Such criteria will include standards for all types of pollutants including natural radionuclides - radium, thorium, etc. - and artificial radionuclides.

(Bureau of Mines) - The Bureau of Mines has statutory responsibility for the control of health hazards due to ionizing radiation in the mineral extractive and related industries. The area of principal concern is the atmospheric control of radon-daughters in uranium mining. Authority is contained in the Federal Metal and Nonmetallic Mine Safety Act of September 16, 1966, a regulatory Act to promote health and safety in metal and nonmetallic industries--Public Law 89-577, 89th Congress, H.R. 8989, September 16, 1966, *see* Enclosure 1.

Department of Agriculture - The U.S. Department of Agriculture has no statutory responsibility or authority for the control of health hazards from the types of radiation indicated in Attachment I because, as a purchaser and user of commercially available products, it has no direct responsibility for the health and safety of the public from such products. However, various research division within the Department do design and fabricate new devices for use in their research. These are controlled by regulations and directives developed and implemented within the Department as discussed in our answers to question two.

Department of Commerce - "No."

Department of Labor - "Yes, control of hazards to employees of contractors under the Walsh-Healey and McNamara-O'Hara Acts and of employees subject to the Longshoremen and Harborworkers Act."

Department of Housing and Urban Development - "No."

Department of Transportation - The Department of Transportation has the statutory responsibility and authority over the transportation of hazardous materials. This jurisdiction is established in the Department of Transportation Act (49 U.S.C. 1657), the Transportation of Explosives Act (18 U.S.C. 831-835), the Federal Aviation Act of 1958 (49 U.S.C. 1421-1430, 1472h), and the Dangerous Cargo Act (46 U.S.C. 375, 416, 170). These authorities and responsibilities relate to the safety requirements for the transportation of hazardous materials, including radioactive materials, via highway, rail, air, and water. This is limited to the radioactive materials as listed in Attachment I, (paragraph A1), as well as those which are regulated under the Atomic Energy Act of 1954, and does not include radiation producing equipment.

Atomic Energy Commission - With respect to the AEC regulatory activities under the Director of Regulation, the AEC is responsible pursuant to the Atomic Energy Act of 1954, as amended, for regulating the possession, use and transfer of byproduct, source and special nuclear materials and the construction and operation of certain nuclear facilities in accordance with safety standards established by rule of the Commission to protect the health and safety of the public. The Act prohibits the possession, use and transfer of such materials and facilities except to the extent authorized by a license issued by the Atomic Energy Commission or pursuant to a specific or general exemption from such licensing.

Regulatory controls are administered through a system of licensing and regulation which assures that organizations and persons possessing or using byproduct, source and special nuclear materials, and constructing or operating nuclear facilities are technically and in some cases financially qualified; that the licensed activity will not endanger public health and safety; and that the facilities and devices themselves meet appropriate safety standards and criteria. AEC regulations governing the issuance of licenses to possess, use and transfer these materials and to operate nuclear facilities are set forth in Title 10, Code of Federal Regulations.

The Commission regulations are not applicable to radioactive materials other than byproduct, source and special materials regulated under the Atomic Energy Act of 1954, as amended, or to electronic products emitting ionizing or non-ionizing radiation as listed in Attachment I of your July 1, 1969, letter. However, the Commission's regulation 10 CFR Part 20, "Standards for Protection Against Radiation," does take into account the exposures to ionizing radiation from such unlicensed materials and electronic products in the following respects as set forth in 10 CFR 20.1(b):

"(b) The use of radioactive material or other sources of radiation not licensed by the Commission is not subject to the regulations in this part. However, it is the purpose of the regulations in this part to control the possession, use, and transfer of licensed material by any licensee in such a manner that exposure to such material and to radiation from such material, when added to exposures to unlicensed radioactive material and to other unlicensed sources of radiation in the possession of the licensee, and to radiation therefrom, does not exceed the standards of radiation protection prescribed in the regulations in this part."

The regulatory requirement for the consideration of exposures from both licensed materials and other sources of radiation was promulgated under the general rule-making authority of Sec. 161 of the Atomic Energy Act of 1954, as amended, (68 Stat. 948; 42 U.S.C. 2201). As a practical matter, this provision for consideration of radiation exposures from non-licensed material most frequently is significant in medical institutions where the technician or physician may use both X-ray equipment and licensed materials. A licensee's records of personnel exposures from all sources of radiation would be reviewed during the course of an inspection visit by a representative of our Division of Compliance.

In the performance of its regulatory responsibilities under the Atomic Energy Act, the AEC is authorized, in accordance with Section 274 of that Act, to transfer regulatory authority over byproduct material, source material, and less than critical quantities of special nuclear materials to the states. This transfer is accomplished by agreement, upon request of the state, and upon a finding by the Commission that the state's program for regulating these materials is adequate to protect the public health and safety and compatible with the Commission's program for the regulation of such materials. Twenty states have entered into agreements with AEC. These are:

Alabama
Arizona
Arkansas
California
Colorado
Florida
Idaho
Kansas
Kentucky
Louisiana
Mississippi
Nebraska
New Hampshire
New York
North Carolina
North Dakota
Oregon
Tennessee
Texas
Washington

With respect to the activities under the General Manager, section 161(i) of the Atomic Energy Act of 1954, as amended, stipulates in part that, in the performance of its functions, the AEC is authorized to:

> "prescribe such regulations or orders as it may deem necessary .... (3) to govern any activity authorized pursuant to this Act, including standards and restrictions governing the design, location, and operation of facilities used in the conduct of such activity, in order to protect health and to minimize danger to life or property...."

AEC, in accordance with the provisions of the Act, must insure that its contractors conduct their activities in a manner prescribed by appropriate AEC policy codes and manual issuances. Should a particular contract include the use of all or part of the sources of radiation contained in Attachment II, then it falls within the authority of the AEC to insure that the use of such sources of radiation is in accordance with safe practice.

Civil Aeronautics Board - "No."

District of Columbia Government - Yes. The District Government is of the view that under its general police powers, the Healing Arts Practice Act (D.C. Code, Sec. 2-101 et seq.), the Act relating to the practice of dentistry (D.C. Code, Sec. 2-301 et seq.), it presently possesses authority to adopt regulations for the control of radiation in the District of Columbia. Copies of these statutes are attached. It is recognized that this authority may be limited in certain areas. For example, the authority for injunctive relief does not appear to be available.

Federal Communications Commission - The short answer to this question is that the Federal Communications Commission has no statutory responsibility or authority for the control of health hazards from the types of radiation indicated in Attachment I. It is, however, guided in its designated areas of responsibility and authority by the basic statutory principle of public interest, convenience and necessity. Accordingly, to the extent that is found under P.L. 90-602 that radiation emission from a radio frequency device represents a health hazard to the public, the Commission would take such findings into account in determining whether the public interest would be served by the grant of applications for Commission type approval or type acceptance of such devices. In connection with the foregoing, as you may know, a Commission Notice of Proposed Rule Making currently outstanding looks toward the adoption of rules requiring type approval or type acceptance of particular kinds of radio frequency devices as a condition precedent to their sale or shipment for sale.

General Accounting Office - No.

Interstate Commerce Commission - The Commission does not have any direct statutory responsibility or authority in this area. However, in reviewing this matter, it appears that we may have some indirect involvement. For example, by law the Commission considers the "fitness" of an applicant for motor carrier operating rights. The applicant's record of compliance with applicable regulations has a strong bearing on the applicant's fitness. Pertinent thereto, as an example, would be the applicant's record of complying with safety regulations, such as those governing the packing, marking, handling, and transporting of dangerous articles, such as radioactive materials. The Commission may deny an application when it finds the applicant unfit, and has done so.

Prior to the transfer of the Commission's safety jurisdiction to the Department of Transportation on April 1, 1967, the Commission promulgated and administered a substantial body of safety regulations governing the packing, marking, and transportation of dangerous articles, such as radioactive commodities. At that time we had direct statutory authority and responsibility for the control of health hazards related to the transportation of such commodities. Subsequent to the transfer of our safety authority to DOT, pursuant to Public Law 89-670, the Commission relies upon safety compliance information furnished to it by the Secretary of Transportation under the terms of Sections 1, 2, 3, and 4 of the attached Memorandum of Agreement between the Commission and DOT. Therefore, it is apparent that the Commission has some measure of indirect control of health hazards by reason of its ability to deny applications for motor carrier operating authority because of poor safety compliance by the applicant.

Government Printing Office - The Government Printing Office has no statutory responsibility or authority for the control of health hazards from the types of radiation indicated in Attachment I. We have established a Health Service Program for employees as provided in Title V, Section 7901 U.S. Code.

Library of Congress - A review of the situation and the nine questions submitted in Attachment II along with your letter indicates that the Library of Congress does not come within the categories described in the quoted Attachment. Therefore, a negative reply is being submitted to your Office.

National Aeronautics and Space Administration - None identified.

Peace Corps.- No.

General Services Administration - Though GSA does not have direct statutory responsibility in this field, the Federal Property and Administrative Services Act of 1949, 63 Stat. 377, as amended, requires that GSA coordinate Federal Standardization Documents with agencies that do have statutory responsibility affecting product requirements.

Health Education, and Welfare:

(Food and Drug Administration) - FDA has responsibility for the safe use of radiation in food processing and in the use of radiopharmaceuticals.

(National Institutes of Health) - NIH has statutory responsibility regarding health hazards stemming from the control of purity, potency, and safety of radiopharmaceuticals of biological origin.

(Health Services and Mental Health Administration) - HSMHA, through its Community Health Service, acts as a primary resource of the Medicare program with the Bureau of Health Insurance. They formulate the conditions of participation for those who provide the service. Regulations and other specific requirements for health and safety include all diagnostic and therapeutic X-ray facilities and services available to Medicare beneficiaries. Also, through its responsibilities under the Hill-Burton Act, general standards are prescribed for hospital construction and equipment (Subpart N, Appendix A, Part 43, Title VI of the Public Health Service Act as amended).

(Social Security Administration) - SSA has primary responsibility for administering the Medicare program. Within the Administration, the Bureau of Health Insurance is responsible for the overall administration of the health insurance program. SSA utilizes the services of official health agencies in determining whether service providers meet the condition for participation in the Medicare program. Services included the array of radiation sources commonly found in hospital environments; in addition, electronic product radiation sources are also reviewed.

(Environmental Control Administration, Bureau of Radiological Health) - Yes. Delegation of authority of Public Law 90-602, the "Radiation Control for Health and Safety Act of 1968" from the Secretary, DHEW, to Administrator, CPEHS, to Commissioner, ECA to BRH. This Law provides for control of the emission of "electronic product radiation" by regulations prescribing performance standards for those products determined to need such standards for the protection of the public health and safety. "Electronic product radiation" is defined in the law as "(A) any ionizing or non-ionizing electromagnetic or particulate radiation, or (B) any sonic, infrasonic, or ultrasonic wave, which is emitted from an electronic product as the result of the operation of an electronic circuit in such a product."

(Environmental Control Administration, Bureau of Water Hygiene) - Promulgates and enforces Drinking Water Standards for potable water used by carriers subject to the Federal Quarantine Regulations. (Title 42, Chapter 1, Subchapter J, Sections 72.201-72.207.)

(Air Pollution Control Administration) - Promulgates criteria for air quality. (Clean Air Act, 42 USC, 1857 et seq.)

Selective Service - No.

Smithsonian Institution - "No."

Tennessee Valley Authority - TVA does not have statutory responsibility; however, a certain authority is established for the control of health hazards from the types of radiation listed in the questionnaire. Attached is a copy of a TVA Instruction, "Control of Radiological Hazards", from our Administrative Release Manual which describes certain responsibilities and designations of authority pertaining to radiological safety, enclosure 1.

Arms Control and Disarmament Agency - "No."

Civil Service Commission - The Civil Service Commission has no statutory responsibility or authority to control health hazards resulting from any type of radiation.

U.S. Information Agency - We have no statutory responsibility or authority for control of radiation hazards.

Veterans Administration - No. The VA has no statutory responsibility or authority for the control of health hazards from the types of radiation indicated in ATTACHMENT I. However, the standard precautionary measures currently available are strictly enforced to avoid the radiation health hazards to our patients and the using personnel.

Post Office Department -

1. Yes.

2a. Public Law 658 - known as the "Public Health Law" - dated August 8, 1946, and all applicable amendments thereto set up the basis for the health service program within the postal service (Attachment A).

b. On January 17, 1969, the Industrial Medical Division was established within the Post Office Department with the stated mission - "Provide full scale and top quality INDUSTRIAL MEDICAL SERVICE for the Post Office Department. Target date, January 1972." A resume pertinent to this division was prepared on October 10, 1968, and a copy of same is attached (Attachment B).

c. The following documents are also pertinent to the Department's health service program:

   1. A compilation of Post Office Department Health Units in operation as of June 1, 1969 (Attachment C).

   2. A current listing of medical personnel - medical units in the Post Office Department (Attachment D).

d. The INDUSTRIAL MEDICAL SERVICE, when fully operational, plans to include radiation monitoring for all Post Office Department personnel who are involved in such operations. The Armed Forces Radiation Board Schedules and Bulletins will be one source of such information.

e. Part 761, SAFETY AND HEALTH ADMINISTRATION under Subchapter 760, SAFETY AND HEALTH PROGRAM of the Postal Manual lists pertinent Post Office Department safety policy (Attachment E).

f. Part 124, NONMAILABLE MATTER in the Postal Manual contains pertinent instructions and a chapter on radioactive matter is included (Attachment F).

BLANK PAGE

## APPENDIX 4

## REPLIES TO QUESTION 2

The following is a summary of the replies to Question 2 as provided by the departments and agencies queried. The detailed materials and supporting documents referenced in the replies are on file in the Bureau of Radiological Health.

QUESTION 2. Has your agency promulgated any regulations, standards, directives, etc., for the control of health hazards from the types of radiation indicated in Attachment I, including the following:

(a) Control of health hazards to the public?
(b) Control of health hazards to agency personnel and contractors?

If affirmative, please describe briefly the regulations, standards, directives, etc., indicating the types of radiation to which they apply and provide a copy of such documents or reference to the documents.

State Department - (a) Nothing concerning the control of health hazards to the public. (b) Yes. Radiological safety programs primarily for Department personnel operating any radiation-producing apparatus. Personnel operating the X-ray machines of the Medical Division are trained and licensed X-ray technicians and radiologists. Personnel operating electronic devices of security or communications in nature are trained in the control of health hazards for themselves and others involved (items used and directives concerning training are classified).

Treasury Department - The Bureau of Customs has not promulgated any regulations, etc., for the control of health hazards from the types of radiation indicated in Attachment I.

Aside from the above, the Bureau of Customs is involved in one program which may or may not be reportable here and is presented for your consideration. This relates to our program to control importation of products which produce a type of ionizing radiation which may be a health hazard. We are on the lookout for articles containing strontium 90, particularly watches and clocks with luminescent faces, dials or hands. Bureau Circular No. X-351, dated February 1, 1960, containing our instructions to the field in this matter is attached.

(Mint) - (a) No health hazards to the public. (b) Ray exposure to working personnel controlled by badges, which must be worn every moment and are read by outside service monthly.

(Administrative Services) - No; however, employees have been advised not to look directly at these UV and infrared lamps and to limit the length of exposure by reflection from objects being examined.

Department of the Army - The Department of the Army, its agencies and subordinate commands have published numerous Army Regulations, Technical Bulletins and Circulars which provide guidance for the protection of Department of the Army civilian employees, military personnel and the general public, when necessary. Some of the principal documents are: Army Regulations (AR); AR 40-5, "Preventive Medicine"; AR 40-13, "Radiological Emergency Medical Teams (REMT)"; AR 40-14, "Control and Recording Procedures Occupational Exposure to Ionizing Radiation"; AR 40-37, "Radioisotope License Program (Human Use)"; AR 55-55, "Transportation of Radioactive and Fissile Materials other than Weapons"; AR 385-10, "Army Safety Program"; AR 385-16, "Safety Color Code Markings and Signs"; AR 385-80, "Nuclear Reactor Health and Safety"; AR 611-15, "Selection and Retention Criteria for Personnel in Nuclear Reactor or Nuclear Weapons Positions"; AR 700-52, "Licensing and Control of Sources of Ionizing Radiation"; AR 700-63, "Control of Radioactive Calibration and Test Items of Supply"; AR 700-64, "Radioactive Commodities in the DOD Supply System"; AR 755-15, "Disposal of Unwanted Radioactive Material"; Technical Bulletins (TB); TB Med 62, "Diagnostic X-ray Protection"; TB Med 232, "Protective Measures Radioactive Material Used in Self-Luminous Light Sources"; TB Med 270, "Control of Hazards to Health from Microwave Radiation"; TB Med 279, "Control of Hazards to Health from Laser Radiation"; TB 750-237, "Identification and Handling of Radioactive Items in the Army Supply System"; USAEHA "Programmed Services, FY 1969".

Department of the Navy - (Office of Chief of Naval Operations) - The following information concerning the control of radiation hazards is forwarded for use in the preparation of a letter to the Department of Health, Education, and Welfare:

a. Directives and Regulations issued:

SECNAV Instruction 5100.10A (enclosure (1))
OPNAV Instruction 5100.8 (enclosure (2))
OPNAV Instruction 5101.1B (enclosure (3))
U.S. Navy Regulations 1948, article 0430 (enclosure (4))

b. Content of directives and regulations

(1) Promulgate policy pertaining to safety through the Department of the Navy.
(2) Assign the Chief of Naval Material responsibility for safety programs as follows:
    (a) Industrial - all aspects of job - related safety including hazards from radiation such as ultraviolet light from welding devices, X-ray from industrial testing devices, infrared, and other radiation from all types of equipment used in industrial processing.
    (b) Hazardous Material - all aspects of safety concerned with the stowage, handling, or use of toxic, oxidizing or radioactive materials.

  - (c) Nuclear Reactors - safety concerned with health hazards associated with operation and maintenance of nuclear reactors.
  - (d) Nuclear Weapons - protection of nuclear weapons against unauthorized or inadvertent events which could result in damage, radioactive contamination, loss or detonation.
  - (e) Electromagnetic Radiation - safety pertaining to the resolution of radio frequency hazards to ordnance, personnel and volatile materials. This includes the utilization of all electronic equipment capable of producing an electromagnetic field including new equipment under development.
- (3) Assign the Chief, Bureau of Medicine and Surgeon responsibility for:
  - (a) Determination, in collaboration with other bureaus concerned, of standards of environmental sanitation, industrial hygiene and measures for the prevention of illness or injury within the Naval Establishment.
  - (b) Occupational Health Safety Program - all aspects of safety concerned with environmental health hazards including industrial hygiene and radiological health hazards.
  - (c) Research into the effects of electromagnetic radiation on biological material and for development of precautionary measures to protect personnel.
- (4) Direct the Chief of Naval Material and the Chief, Bureau of Medicine and Surgery to:
  - (a) Insure that safety is designed and engineered into equipments provided by the Naval Material Command and the Bureau of Medicine and Surgery.
  - (b) Insure that safety precautions, technical manuals and procedures are prepared, issued and kept current for equipments, supplies and facilities provided by their activities.
- (5) Direct the Chief of Naval Personnel to:
  - (a) Include rf hazard information, safety precautions, and other safety information in instructional curricula under his cognizance.
  - (b) Insure that pertinent safety precautions are incorporated into various training publications issued by the Bureau of Naval Personnel.

(BUMED) - The Bureau of Medicine and Surgery has promulgated directives for the control of health hazards from Ionizing and LASER radiation. NAVMED P-5055, "Radiation Health Protection Manual," provides regulations intended for observance during peacetime by all Naval activities possessing or utilizing sources of ionizing radiation which may affect the health of personnel. NAVMED P-5052-35, "Control of Hazards to Health from LASER Radiation," provides guidelines for Army and Navy personnel protection within the framework of currently documented experimental evidence. A copy of each document with changes is forwarded as an enclosure.

Microwave threshold exposure guidance established by the Bureau of Medicine and Surgery is included in the following documents:

a. NAVSHIPS 0900-005-8000, "Technical Manual for Radio-Frequency Radiation Hazards." (Attached)
b. NAVORD OP 3565/NAVAIR 16-6-529, "Technical Manual, Radio-Frequency Hazards to Ordnance, Personnel, and Fuel." (Confidential)
c. NAVSO P-2455, "Safety Precaution for Shore Activities." (Attached)

(NAVELEX) - NAVMATINST 8020.1B specifically assigns certain responsibilities to NAVELEX for the overall Explosive Safety Program. These are to coordinate the installation of electronic transmitting equipment with NAVORD to determine the effects on Ordnance; provide NAVORD with field strength measurements when necessary to determine the electromagnetic environment with respect to HERO; and to provide radio detection identification and computation (RADIAC) equipment required for radiological safety Navy-wide, reference NAVELEXINST 8020.1.

NAVELEX functions as the Atomic Energy Commission (AEC) licensee for all AEC radioactive material procured by NAVELEX, the Naval Ship Systems Command (NAVSHIPS), the Naval Supply Systems Command (NAVSUP) and their field activities and forces afloat. It also exerts control over some materials outside AEC cognizance. In both instances NAVELEX provides safety consultation for use of the radioactive material and issues instruction for its control. Basic Radiological Safety Standards are spelled out in NAVMED P-5055 radiation Health Protection Manual. Requirements peculiar to the Navy's nuclear propulsion program and nuclear weapons are established by NAVSHIPS and NAVORD. Reference NAVELEXINST 9673.2 and 9673.3. NAVELEXINST 5100.1 Radioluminescent Material, Hazards of and 5100.2 Radioluminescent Material, Control of.

(NAVSUP) - NAVSUP has not promulgated any regulations, standards, directives, etc., for control of radiation hazards to the public. NAVSUP has, however, promulgated enclosures (1) and (2), which offer guidance to personnel under NAVSUP control concerning radioactive material handling and disposal. Encl: (1) NAVSUP Instruction 4510.27; (2) BUSANDA Instruction 5100.10.

(NAVFAC) - Yes. NAVFAC Instruction 8020.3 - Subject: Site Approvals for Electromagnetic Wave Generating and Transmitting Equipment - Copy attached.

(NAVSHIPS) - a. No. However, the Naval Ship Systems Command cosponsors with IEEE the United States of America Standards Institute C-95 Sectional Committee on Radio Frequency Radiation Hazards. This group has published U.S.A. Standard Safety Level of Electromagnetic Radiation with respect to personnel, USAS C95.1-1966.

b. Publication of a technical manual for Radio-Frequency Radiation Hazards, NAVSHIPS 0900-005-8000.

Department of the Air Force - Air Force publications, as enumerated in this report, establish policies, responsibilities, criteria, and standards for a program to control or eliminate exposure to electronic product radiations. Many of the referenced documents are provided as Attachment 4 to this report.

(a) The USAF does not knowingly permit exposure of the public to the materials cited in Section A.1.

(b) The control of radioactive materials (from any source) in the Air Force is covered by the following directives:

(1) AFR 160-57 - Using Radioactive Materials in Medical Facilities.

(2) AFR 160-124 - Radioisotope Licenses and Permits.

(3) AFR 160-132 - Control of Radiological Health Hazards.

(4) AFR 161-8 - Control and Recording Procedures Occupational Exposure to Ionizing Radiation.

(5) AFR 161-11 - Film Dosimetry Program.

(6) T.O. 00-11 ON-2 and T.O. 00-11 ON-3 - Covers Acquisition, Handling, Storage, and Disposal of Radioactive Materials in the Air Force.

(c) The USAF does not knowingly permit exposure of the public to the materials cited in Section A.2.

(d) The control of electromagnetic and particular radiation from the electronic products of Section A.2 is covered by the same regulations and directives and standards previously mentioned for radioactive materials. Additionally, several manuals and guides for the safe use of X-ray machines have been prepared for Air Force use by the USAF Radiological Health Laboratory, Wright-Patterson AFB Ohio. Documents and procedures representative of the USAF control program are:

(1) Portable X-ray Standard Operating Procedure.

(2) MIL-R-9673.

(3) Procedures for Medical X-ray Protection Surveys.

(4) TO 31Z-10-4.

(5) AFM 161-4 - Medical X-ray and Gamma Ray Protection for Energies up to 10 MeV.

(6) TO 33B3-1-1 - Inspection of Material, Radiography. In addition, the Dental Surpak program conducted by USPHS has been modified and is used to perform an annual survey of all dental X-ray machines.

(7) AFM 167-1, Preventive Maintenance Procedures and Serviceability Standards for Medical Equipment, contains specific safety precautions for items of equipment involved in the production of radiation.

(8) AFM 67-1, Volume V, Chapter 6, provides procedures for reporting hazards found inherent in medical equipment items. Corrective action is then taken on all USAF inventories.

(9) Training textbooks used at the USAF Medical Service School include safety information concerning hazards related to electronic radiation producing equipment.

(10) Review by the Medical Equipment Maintenance Branch of radiation surveys conducted by the Radiological Health Laboratory, Wright-Patterson AFB, for maintenance considerations related to health hazards.

(11) Articles are routinely published in the Air Force Medical Materiel Field Letter concerning safety as it relates to medical equipment for both the user and the operator.

B.1 (a) The USAF does not knowingly permit exposure of the public to ultraviolet light.

(b) The USAF has very recently published one of the most complete documents on ultraviolet radiation. A copy of this Technical Report, SAM-TR-69-10, "The Effects of Ultraviolet Radiation on the Eye," is attached. This publication, together with specific references in AFP 161-2-2, "Health Precautions for Welders and Solderers," AFM 127-101, "Accident Prevention Handbook," and appropriate notes in technical orders and manufacturers' instructions and guides, provide workers with warning of potential health hazards involved in these procedures.

AFM 167-1, Preventive Maintenance Procedures and Serviceability Standards for Medical Equipment, contains specific safety precautions for items of equipment involved in the production of radiation.

AFM 67-1, Volume V, Chapter 6, provides procedures for reporting hazards found inherent in medical equipment items. Corrective action is then taken on all USAF inventories.

Training textbooks used at the USAF Medical Service School include safety information concerning hazards related to electronic radiation producing equipment.

Review by the Medical Equipment Maintenance Branch of radiation surveys conducted by the Radiological Health Laboratory, Wright-Patterson AFB, for maintenance considerations related to health hazards.

Articles are routinely published in the Air Force Medical Materiel Field Letter concerning safety as it relates to medical equipment for both the user and the operator.

AFR 161-18 - "Use of Potentially Toxic Agents and Hazardous Materials".
AFR 160-112 -"Occupational Vision Program".

B.2 The Air Force does not now have standards for exposure to intense sources of incoherent visible light. For a number of years, however, the Air Force has been involved in evaluating the hazard of intense flashes of light to the success of an aerospace mission. Although performed for a specific military reason, the results of this research may well provide a foundation on which standards for exposure may be based. A recent publication is provided as an example of research being conducted by the USAF. Work is continuing to refine, in terms of human data, existing animal data which has shown recovery time to be a function of at least the object illumination, the visual task to be performed, and the pupil diameter.

B.3 (a) The USAF does not knowingly permit exposure of the public to infrared radiation from operations under its control.

(b) The USAF has no specific directive related exclusively to the subject of health hazards associated with infrared and its control. AFP 161-2-2, Health Precautions for Welders and Solderers, does address itself to infrared hazards in these operations. Technical orders covering specific operations, which involve potential exposure to infrared, generally contain warning notes cautioning workers to avoid prolonged exposure to infrared involved in these operations. The USAF Systems Command was tasked with the responsibility to develop an Air Force directive which would fulfill this needed requirement. Preparation of this document is currently in progress at the USAF School of Aerospace Medicine.

(1) AFM 67-1, Vol V, Chap 6, provides procedures for reporting hazards found inherent in medical equipment items. Corrective action is then taken on all USAF inventories.

(2) AFP 161-2-2, Health Precautions for Welders and Solderers, 7 February 1962 (AFP 161-2-2A, 5 June 1962).

(3) AFM 127-101, Accident Prevention Handbook, 30 December 1965.

(4) AFR 161-18, Use of Potentially Toxic Agents and Hazardous Materials, 12 October 1965.

(5) AFR 160-112, Occupational Vision Program, 12 June 1961, (Change 1, 22 June 1967).

B.4 (a) The USAF does not knowingly permit exposure of the public to microwave radiation. AFR 100-6 requires reduction of electromagnetic radiation hazards to the maximum practical extent. USAF radar and other electronic facilities are sited with public safety in mind. The following listed documents (pertaining to the acquisition and maintenance of communications and electronics systems) contain requirements for consideration of radiation hazards:

(1) AFM 100-17, C-E Facility and System Planning

(2) AFM 100-18, USAF Ground Communications-Electronics Program Management

(b) The control of health hazards from microwave radiation is covered by the following directives:

(1) AFM 161-7, Control of Hazards to Health from Microwave Radiation, 6 December 1965

(2) AFR 100-6, Ground Electromagnetic Interference and Radiation Hazards, 28 December 1966

(3) AFM 100-17, C-E Facility and System Planning, 12 June 1967 (Change 1, 15 February 1968)

(4) AFM 100-18, USAF Ground Communications-Electronics Program Management, 22 April 1968 (Change 1, 23 August 1968)

(5) AFR 161-18, Control and Recording Procedure - Occupational Exposure to Ionizing Radiation, 29 September 1966

(6) MIL-R-9673C (USAF), Radiation Limits, for Personnel Safety, on Designated Types of Electromagnetic Radiation from Electronic Equipment (Proposed Draft - 1 August 1969)

(7) Policy Letter, Hq USAF (AFMSPAP), Microwave Ovens, 11 July 1968

(8) Policy Letter, Hq USAF (AFMSPAP), Microwave Ovens, 1 July 1969

(9) TO 31Z-10-4, Electromagnetic Radiation Hazards, 1 August 1966 (Change 1, 10 May 1967)

(10) McClellan EHL Report 69M-6, Hazards Associated with the Operation of Microwave Ovens, March 1969.

B.5 The Air Force does not now have standards for exposure to radio or low frequency electromagnetic generating devices. General safety procedures prescribed in AFM 127-101, and preventive maintenance procedures and serviceability instructions contained in AFM 167-1, are followed.

B.6 (a) The USAF does not knowingly permit exposure of the public to Laser/Maser devices.

(b) The control of Lasers/Masers in the USAF is covered by the following directives:

(1) AFR 161-24, Laser/Maser Hazards, 12 January 1967

(2) AFM 161-8, Laser Health Hazard Control, 1 April 1969

(3) Specification MIL-R-9673C, Radiation Limits, for Personnel Safety, on Designated Types of Electromagnetic Radiation from Electronic Equipment. (Proposed change.)

C.1 The USAF does not have standards for exposure to infrasonic vibrations. For a number of years, however, the Air Force has been involved in research aimed at determining the biological effect of intense sound in the low frequency on man and weapon systems. The results of this research may well provide the basis on which the USAF will establish standards if a potential health hazard is shown to exist.

C.2 (a) The USAF does not knowingly permit exposure of the public to sonic vibration oscillators under its control. Signal devices considered in this category (sirens, klaxon devices) are generally located at positions on Air Force installations which do not create a potential hazard to the public.

(b) The control of sonic vibrations to Air Force and contractor personnel is covered by the following directives:

(1) AFR 160-3, Hazardous Noise Exposure, 29 October 1956 (AFR 160-3A, 27 June 1960, AFR 160-3B, 7 February 1967)

(2) AFM 86-5, Land Use Planning with Respect to Aircraft Noise, 1 October 1964

(3) AFR 160-54, Diagnostic Hearing Center, 29 October 1956 (AFR 160-54A, 7 April 1959)

(4) AFM 161-2, Aerospace Systems Management-Medical, 27 November 1963.

C.3 (a) The USAF does not knowingly permit exposure of the public to ultrasonic vibrators.

(b) Control of health hazards from ultrasonic vibrators is covered by AFR 160-3, Hazardous Noise Exposure, and AFP 161-6-4, Health Hazards and Their Control if Metal Degreasing.

Additionally, it has been recommended that AFLC Purchase Description, SANE No. 50A, dated 26 October 1965 (as revised), "Cleaner, Filter Element; Ultrasonic," include in its revision the standards listed in appendix to this Page - Page 25a, entitled, "Acceptable Sound Pressure Levels for Ultrasonic Cleaners."

Department of Justice - Our agency (Bureau of Prisons) has established an agreement with the Division of Radiological Health, U.S. Public Health Service, for a continuing surveillance directed toward reducing unnecessary exposure to ionizing radiation from sources of medical and dental x-rays. A copy of the agreement and our policy statement is enclosed.

Department of Interior - For the protection of Department personnel in the telecommunications area, the Director of Management Operations anticipates adding Section 8.2.28, "Radiation Hazards," of the Interdepartment Radio Advisory Committee/Director of Telecommunications Management Manual to the Interior Departmental Manual. A copy of this directive is attached (Attachment A).

The pertinent regulations, standards, and directives of the Bureau of Reclamation are summarized below in accordance with the types of radiation to which they apply:

a. Ionizing electromagnetic and particulate radiation

1. Radioactive materials - Storage, use, and handling are subject to the provisions established under the Atomic Energy Act of 1954. Reference is also made to the National Bureau of Standards Handbook 42, "Safe Handling of Radioactive Isotopes." Also, safety directives are issued applicable to the use of specific equipment, i.e., X-rays, density probes, etc.

2. X-ray machines - Contractor use of X-rays (examining welds) is subject to compliance with the provisions as set forth in the National Bureau of Standards Handbook 50, "X-Ray Protection Design." Such use is also covered in the Reclamation publication, "Construction Safety Standards." The use of X-ray equipment by Bureau personnel is subject to the same standards, together with safety provisions recommended by the respective manufacturers of the equipment.

b. Non-ionizing electromagnetic radiation

1. Arc welding equipment - Specific health and safety requirements pertaining to radiation and respiratory hazards from arc welding are set forth in two Bureau publications, "Construction Safety Standards" and "Reclamation Instructions - Series 590 Safety Techniques and Standards." Further, the procurement and use of all arc welding equipment is governed by standards promulgated by the following associations:

i. National Electrical Manufacturers Association Electric Arc Welding Machine Standards.
ii. USASI Z49.1 - Safety in Welding and Cutting.
iii. The Institute of Electrical and Electronic Engineers, Inc.
iv. National Electrical Safety Code.

2. Lasers (helium) - In addition to manufacturers' safety recommendations, the criteria utilized are those set forth in the publication of the American Conference of Governmental Industrial Hygienists, "A Guide for Uniform Industrial Hygiene Codes or Regulations for Laser Installations."

3. Radars - All of the radars presently used in Reclamation field programs are surplus military sets, some of which have been substantially modified. Military handbooks are used by personnel responsible for the operation and maintenance of this equipment.

The Federal Water Pollution Control Administration is currently working with the U.S. Public Health Service and the Atomic Energy Commission on the development of a radioactivity standard for surface and ground water. For specified water uses - drinking water supply, recreation, and the production or processing of foodstuffs - concentration limits will be set for non-volatile gross beta and individual radionuclides (artificial and natural). It is anticipated that this standard will be submitted to the individual States with the recommendation that the standard be as a water quality criterion applicable to inter- and intra-State waters.

(Bureau of Mines) - (a) Control of Health hazards to the public? Standards for radon-daughters control for members of the public engaged in mining are under way. A Notice of Proposed Rule Making on Health and Safety Standards was issued in the Federal Register, Vol. 34, No. 11, Thursday, January 16, 1969. See Enclosure 2.

(b) Control of health hazards to agency personnel? Regulations and standards have been promulgated for the control of health hazards covering the sources of ionizing radiation listed under Sections A 1 and A 2, Attachment I. The regulations prescribe health and safety measures to be followed by Bureau personnel for protection against radiation hazards arising from use of radioactive materials and other ionizing radiation-producing media. See Enclosure 3, Bureau of Mines Manual Chapter 395.20, Protection Against Ionizing Radiation. Also see Enclosures 4, 5, and 6, Samples of Operating Procedures for X-ray items. Bureauwide regulations or standards have not been promulgated for the types of electronic products listed under Sections B and C, Attachment I.

This equipment is operated in accordance with the instructions of the manufacturer and in many instances these instructions are supplemented with local operating procedures and safeguards. Examples, see Enclosures 7, Operating Procedure, Plasmas Torch; 8, Operating Procedure, RFC Induction Dielectric Heater; 9, Operating Procedure $CO_2$ Laser; 10, Operating Procedure, Helium Neon Laser; and 11, General Laser Safety Procedures.

Department of Agriculture - On July 21, 1958, the Agricultural Research Service of the U.S. Department of Agriculture published in the Federal Register a notice of organization, functions and authorities which amended Section IIA of 22 F.R. 2679 entitled "Assignment of Functions" to add paragraph 14 which reads:

> 14. All administrative functions on behalf of the Secretary relating to radiological safety within the Department, including control of the acquisition, use and disposition, from a standpoint of radiological safety, of all materials and equipment which are sources of actual and potential radiation hazard.

As a result of the above, numerous Administrative Regulations, Administrative Memoranda, Radiological Safety Committee Memoranda, and a Radiological Safety Handbook have been prepared and issued to control the acquisition, safe use and disposal of radioactive materials and/or equipment which emanates ionizing radiation. Attached are copies of the regulations, memoranda and Handbook. The Handbook is currently being extensively revised, and a vastly more useful version will be available for distribution in a short time.

It should be pointed out, however, that the Radiological Safety Staff has limited its jurisdiction to control over naturally occurring and artificially produced radioactive materials and to equipment which emits alpha, beta, gamma, neutron and x-radiation as listed in Section OV of AM 210.14. The RSS has not been directly concerned with equipment which emanates sound waves, radio waves or visible, infra-red or ultra-violet light.

Code of Federal Regulations, Title 0, Chapter III, "Animal and Animal Products" and particularly Section 311.41 specifies requirements for disposition of meat from animals which have been exposed to radiation.

(a) Long standing policy of most laboratories prohibits any unaccompanied guests from entering laboratories. Visitors to hazardous areas are provided necessary personal protective equipment.

(b) Access to hazardous areas such as laser laboratory and ultraviolet use areas is restricted. Personal protective equipment is furnished and required as need dictates. Eye examinations are required for laser operators.

This equipment is operated in accordance with the instructions of the manufacturer and in many instances these instructions are supplemented with local operating procedures and safeguards. Examples, see Enclosures 7, Operating Procedure, Plasmas Torch; 8, Operating Procedure, RFC Induction Dielectric Heater; 9, Operating Procedure $CO_2$ Laser; 10, Operating Procedure, Helium Neon Laser; and 11, General Laser Safety Procedures.

Department of Agriculture - On July 21, 1958, the Agricultural Research Service of the U.S. Department of Agriculture published in the Federal Register a notice of organization, functions and authorities which amended Section IIA of 22 F.R. 2679 entitled "Assignment of Functions" to add paragraph 14 which reads:

> 14. All administrative functions on behalf of the Secretary relating to radiological safety within the Department, including control of the acquisition, use and disposition, from a standpoint of radiological safety, of all materials and equipment which are sources of actual and potential radiation hazard.

As a result of the above, numerous Administrative Regulations, Administrative Memoranda, Radiological Safety Committee Memoranda, and a Radiological Safety Handbook have been prepared and issued to control the acquisition, safe use and disposal of radioactive materials and/or equipment which emanates ionizing radiation. Attached are copies of the regulations, memoranda and Handbook. The Handbook is currently being extensively revised, and a vastly more useful version will be available for distribution in a short time.

It should be pointed out, however, that the Radiological Safety Staff has limited its jurisdiction to control over naturally occurring and artificially produced radioactive materials and to equipment which emits alpha, beta, gamma, neutron and x-radiation as listed in Section OV of AM 210.14. The RSS has not been directly concerned with equipment which emanates sound waves, radio waves or visible, infra-red or ultra-violet light.

Code of Federal Regulations, Title C, Chapter III, "Animal and Animal Products" and particularly Section 311.41 specifies requirements for disposition of meat from animals which have been exposed to radiation.

(a) Long standing policy of most laboratories prohibits any unaccompanied guests from entering laboratories. Visitors to hazardous areas are provided necessary personal protective equipment.

(b) Access to hazardous areas such as laser laboratory and ultraviolet use areas is restricted. Personal protective equipment is furnished and required as need dictates. Eye examinations are required for laser operators.

Atomic Energy Commission - The mechanism through which the AEC channels its basic policies, standards and management directives to its contractors to guide their safety programs is the AEC Manual Chapter directives system. All contractors are required to comply with the provisions of the Manual Chapters to insure "control of health hazards to the public, agency personnel, and its own workers."

Attachment I contains the current Manual Chapter 0524, "Standards for Radiation Protection," establishes the basic requirements for the program. No specific distinction is made between the source terms as noted in A-1 and 2 of Attachment II (your transmittal); rather, the contractor is required to establish specific procedures for his facility to insure that exposures are well within the dose equivalent limits prescribed in Manual Chapter 0524.

Concerning items under B and C of Attachment II, our basic guides are the following references:

a. Laser Eye Effects - Armed Forces NRC Committee on Vision, April 1968;
b. An Annotated Bibliography of Regulations Standards and Guides for Microwaves, Ultraviolet Radiation, and Radiation from Lasers and Television Receivers - USHEW, April 1968;
c. Hazardous Noise Exposure - Department of Air Force Regulation 160-3.

Manual Chapter 0550, "Standards for Health and Safety", which incorporates a listing of all pertinent codes, standards, guides, and basic references, includes Air Force Regulations 160-3 noted in (c) above. Manual Chapter 0550 is currently being modified to include (a) and (b) above also.

Civil Aeronautics Board - "N.A."

District of Columbia Government - (a) Control of health hazards to the public:

1. Registration of Sources of Ionizing Radiation Title 8, Chapter 4, Part 10, Health Regs. (Attachment #A.)
2. Radiological and Radioisotope Services of Hospitals (Attachment #B).
3. Radiation Protection Standards.

The Department of Public Health has appointed an Advisory Committee of radiation experts who are not D.C. employees. It is the responsibility of the Committee to recommend standards for radiation protection applicable to all types of radiation sources, both ionizing and non-ionizing.

With only a few exceptions, this Committee has endorsed the recommendations of the National Council on Radiation Protection as standards applicable to ionizing radiation. No standards applicable to non-ionizing radiation have been adopted; however, the Department of Public Health has recognized the standards of the Department of the Army with respect to microwave radiation hazards, and the standards recommended by the American Conference of Governmental Industrial Hygienists with respect to sonic noise and lazer radiation.

(b) Control of health hazards to agency personnel and contractors: To the extent of the available resources, the Department of Public Health has voluntarily assumed responsibility for protection of D.C. Government personnel from unnecessary ionizing radiation.

Initially, in 1966, this extended throughout the Department of Public Health (approximately 200 radiation workers). Subsequently, the Department of Corrections, and the Department of Welfare was included, adding an additional 25 radiation workers. The only District Agency having radiation workers which is not included in this internal radiation control program is the Office of Civil Defense.

A copy of the radiation safety policies and procedures is attached (Attachment #C). It should be noted that the Department of Public Health has no authority to impose these policies and procedures on other District agencies; thus the extent of participation of other D.C. Agencies is voluntary.

Federal Communications Commission - The Commission has not promulgated any regulations, standards or directives for control of health hazards from the types of radiation listed in your Attachment I. There is a long history of FCC regulations relating to hazards of electrical shock, fire, and collision of aircraft with antennas; these have applied principally to AM, FM, and TV broadcast stations. The Commission and its predecessors have been associated from their beginning with measures to employ radio to protect life and property at sea. It has also long taken measures to preserve aircraft and ship operational and navigational frequencies from harmful interference. Therefore, I think it may be said that the Commission's lack of regulations relating to the types of radiation you are studying is not the result of unconcern for safety or lack of authority. Rather it is because the health hazard from such radiations has not been defined, and because the equipment over which it has jurisdiction has tended to be constructed and operated in a manner that significant practical radiation hazards have not been known to exist.

General Accounting Office - No.

Interstate Commerce Commission - Prior to April 1, 1967, the Commission did promulgate regulations governing the safety of transportation of explosives and other dangerous articles (see 49 CFR 171-180). Subsequent to April 1, 1967, we have promulgated no regulations directly bearing on control of health hazards to the public nor to agency personnel nor contractors.

National Aeronautics and Space Administration -

(Ames Research Center) - The Center has adopted and published directives for the control of various health hazards of the type specified in Attachment I. We have covered in detail, only radioactive materials, x-ray machines, and laser operations. These directives cover the control of hazards to the public as well as installation and contractor personnel. The major document, Enclosure A, sets forth the Administrative and Radiation Safety Procedures for the Center, in detail. The index of this document is as follows:

I. Radioisotope and Radiation Safety Committee
II. Record System
III. Safety Procedures
IV. Purchasing
V. Radioisotope Areas
VI. Storage
VII. Sealed Radiation Sources
VIII. Waste Disposal
IX. Delegated Radiological Authority

Enclosure B is used by the Safety Officer as a guide for the safe operation of lasers.

(Electronics Research Center) -
a. Small amounts of toxic materials are generated in the course of performing the electronics research; however, these items are sufficiently diluted so as not to present a problem to the public. Radiation warning signs and lights are present in most areas where radiation producing equipment is located. The public is also restricted by General Services Administration guards who patrol operational areas.

b. This Center has a radiation protection program which is administered by the Health and Safety Office. Individuals who are exposed to ionizing radiation are required to undergo physical examinations on an annual basis and undergo blood testing on a semi-annual basis (see Attachment #1). The Electronics Research Center Safety Guide (Attachment #2) covers the subject of "Radiation" on pages 43 through 49. A copy of this publication is furnished all employees.

(Flight Research Center) - We are enclosing Attachments (a) through (k) as applicable documents which have been published or used by this Center for the control of health hazards.

(a) Memorandum for Posting, Subject: Radiation Protection, dated April 18, 1969 by George F. Schwartz, Jr.

(b) Safety Standards and Codes, FRC Safety Manual 5. Radiation Protection.

(c) Safety Plan for the X-Ray Boundary Layer Air Density/Temperature Sensor, by General Nucleonics Division of Tyco.

(d) Federal Register, Safety and Health Standards, Vol. 34, Number 12, Part II, dated January 17, 1969.

(e) Air Force Regulation Number 161-24, Aerospace Medicine Laser/Maser Hazards, dated January 12, 1967.

(f) Goddard Space Flight Center letter to NASA FRC, Subject: Laser Evaluation Checklist, dated May 14, 1969.

(g) Health and Safety Information, U.S. AEC, Issue Number 280, Filter Unit Inspection and Testing Service, Fiscal Year 1970, dated June 4, 1969.

(h) NASA Headquarters (BXB) letter to NASA FRC, Subject: Updating and Expanding of NPC 325-1, dated June 1969.

(i) Memorandum to Library, Request for Radiation documents.

(j) NASA SP-5045, Contamination Control Principles.

(k) Accident Prevention, FRC Safety Manual 5. Inspection of Scrap Metal, dated January 1, 1969.

(Langley Research Center) - Langley Research Center has regulations concerning ionizing radiation and lasers (Attachments 1 and 2). On other items the established national standards are followed.

(Lewis Research Center) - NASA Lewis has established standards and/or manuals for the safety elements associated with the following radiation producing devices:

| Device | Radiation |
|---|---|
| 60" cyclotron | 21 Mev deutrons, 42 Mev alphas, various radionuclides |
| Dynamitron | electrons, protons, various radionuclides |
| X-ray - machines<br>-diffraction instruments | X-rays |
| Electron beam guns | electrons |
| Neutron generators | deuteron ions, tritium |

The standards used to achieve the radiation safety are in the form of manuals (cyclotron, dynamitron), Health Physics Guides, and memoranda that are distributed to appropriate personnel. (NOTE: Mr. R.E. Alexander, Manager, Radiological Health at NASA Headquarters, visited Lewis on June 19, 1969, to review radiation safety. As a result of his visit he received copies of: Safety Manual for Cyclotron, Safety Manual for Dynamitron, Health Physics Guides (15), safety organization.)

The Plum Brook Reactor Facility (PBRF) has promulgated over 100 facility procedures, 50 implementing procedures, and 12 standards related to the health and safety program at PBRF. These procedures and standards are directed to the control of the hazards associated with the use of radioactive material and radiation producing equipment, both for radiation workers and for the general public. The volume of printed material is too bulky and detailed to forward with this letter. However, we are enclosing several representative procedures to demonstrate the coverage and detail provided in these procedures. The procedures and standards manuals relate to the operation of a nuclear test reactor and associated equipment and facility, a hot laboratory complex, and a radiochemistry laboratory.

The PBRF is licensed by the AEC to operate the 60 MW (th) test reactor, the 100 KW (th) Mockup Reactor, and to possess and use in excess of 2,000,000 curies of byproduct, source, and special nuclear material. Approximately 200 persons routinely work in radiation areas or with radioactive materials. All such activities are governed by procedures and standards approved by the Division Chief, the Health Safety Officer, and the Safeguards Committee and/or Radiation Safety Committee.

(Jet Propulsion Laboratory) - The JPL Safety Office publishes a document entitled SAFETY CLIPS which describe potential hazards and acceptable methods of dealing with these problems. The hazard is set forth and tells what could happen if proper precautions are not adhered to. (Sample SAFETY CLIP attached.) A subject file is kept by the Safety Office on lasers, microwaves, noise, etc. This is enlarged as new articles appear in journals and periodicals.

(Kennedy Space Center) - KMI 1710.1A, "The KSC Safety Program"; KMI 1810.1B/1S, "KSC Medical and Environmental Health Programs"; KMI 1710.8, "Radiation Safety - Policies and General Procedures".

(Mississippi Test Facility) - In the medical services operation, no written regulations or directions for x-ray equipment usage has been prepared. The manufacturer's operating manual is followed in the operation of the diathermy units.

In the industrial type component of the support contractor, the MTF organization has complied with the regulations of the Mississippi State Board of Health. Operating procedures are in use which include rules and regulations for safe practice in accordance with requirements of the Mississippi State Board of Health. However, no such control is exercised in the case of other types of radiation equipment used in the support contractor's laboratory. A copy of applicable procedures is attached.

This installation (contractor G.E.) has complied in full with the regulations of the Mississippi State Board of Health with respect to Industrial X-Ray equipment. Operating procedures are in use which include rules and regulations for safe practice in accordance with requirements of Mississippi State Board of Health.

No such control is exercised in the cases of other types of radiation equipment used in this laboratory. Copies of applicable procedures are enclosed.

The North American Rockwell Corporation has issued an Industrial Safety Standards Manual for the control of health hazards to installation personnel. The manual is in conformity with the NASA/MTF Safety Manual (a copy of a part of the MTF Manual covering radiation hazards was not attached to my July 3 memo but is now attached for your review).

(Marshall Space Flight Center) - The Marshall Space Flight Center does have regulations for the control of health hazards from various types of ionizing radiation in the form of a Radiological Control Manual, a copy which is appended hereto as appendix 1.

Regulations in the form of an Environmental Health issuance in the Safety and Environmental Health Standards Manual have been applied to ultraviolet radiation from various sources. A copy of that issuance, No. 8-2, is attached hereto as appendix 2.

"General Safety Guide for Laser Users" is included in the Safety and Environmental Health Standards Manual as Section No. 8-2. A copy of this section is included as appendix.3.

(Michoud Assembly Facility) - Michoud Assembly Facility is a government-owned, contractor-operated facility and being such has not promulgated per se any regulations, standards, directives, etc., for the control of health hazards from the types of radiation indicated in attachment I to reference NASA Headquarters memorandum.

The primary contractors are the Boeing Company, Chrysler Corporation, Mason-Rust, and Service Technology Corporation. Each contractor has promulgated regulations and directives tailored to their respective type of operations.

All standards are implemented for protection of the general public as well as installation and contractor personnel to insure the safety of all individuals on the Michoud Assembly Facility.

(1) Boeing controls established apply to:
    (a) Microwave Radiation
    (b) X-Radiation from Electronic Tubes
    (c) Ultraviolet Radiation
    (d) Ionizing Radiation
    (e) X-Radiation from X-Ray Generating Equipment
    (f) Lasers and Masers
(2) CCSD directives are:
    (a) Organization Charter for the Radioactive Materials Committee of the Engineering Division, Chrysler Corporation.

(b) Radioactive Materials Committee - Operating Manual.
(c) Procedure for Safe Handling and Usage of Ionizing Radiation Operations.

(3) Mason-Rust:
(a) Equipment involving radiation is operated only by qualified personnel and the areas of operation are safeguarded against inadvertent exposure by unauthorized personnel. USASI Standard C95.1 is the primary regulatory document used for controlling radiation health hazards.

(4) Service Technology Corp., Technical Services Division:
Negative with exception of a (white light) device on oscillographs.

(The Goddard Space Flight Center) - The Goddard Space Flight Center has generated, adopted, and/or adapted regulations, standards, directives, and guidelines; which cover both control of health hazards to the general public as well as to installation personnel and contractors. These regulations, standards, directives, and guidelines are attached as Tabs A through E of Part III. A list identifying the document, and tab letter follows:

A. Radiological Safety Handbook (Revision initiated January 1969)
B. Instructions for the Procurement, Transfer, Custody, Use, Storage and Disposal of Radioactive Materials Associated with GSFC Spacecraft or Payload (R.O. Proc. No. 60)
C. Administrative Control Procedures for Sources of Ionizing Radiation (includes copies of: Request for approval of Radioactive Materials Custodian, GSFC 23-14; and, Record of Action on Request Involving Sources of Radiation, GSFC 23-6)
D. GSFC Announcement No. 1190, "Shipment, Transfer and Receipt of Radioactive Materials"
E. "Standards for Health, Safety, Fire Protection, Health Physics, Industrial Hygiene and Medical" (References all the standards and guidelines which were applicable, when compiled by GSFC personnel, in establishing limits and area survey requirements)

Tabs A through D concern ionizing radiation while Tab E concerns non-ionizing as well as ionizing radiation. One directive neither referenced above nor included, because of its bulk, is the "Network Operations Directive for Manned Spaceflight Operations". Integrated into this multivolume directive are the safety guidelines and operational limits for the Manned Flight Support Network, For information purposes we have included in E above a portion of Section 40 "Station Operating Procedures" of the referenced directive to illustrate the integration of safety guidelines into operational procedures.

Peace Corps - "No."

General Services Administration - "No."

Government Printing Office - The Government Printing Office has not promulgated any regulations or standards for the control of radiation hazards indicated in Attachment I. We feel that it is well beyond the scope of our responsibilities or present capabilities to initiate a meaningful research program for the purpose of producing regulations or standards to control this wide range of radiation hazards.

Department of Health, Education, and Welfare:

(Food and Drug Administration) - FDA has guidelines for this program which are set forth in the manual "Guide for Radiological Safety in FDA Facilities."

(National Institutes of Health) - NIH has controls affecting agency personnel, Clinical Center patients, visitors, and contractors in the form of a number of regulations, standards and directives.

(Health Services and Mental Health Administration) - HSMHA has control through the Regional Medical Programs Service which limits the loan of radium (under Section 402, PHS Act), to institutions meeting certain requirements and agreeing to acceptance of certain conditions. The Division of Health Standards, CHS-HSMHA, has actively participated with the Bureau of Health Insurance, SSA, in formulating regulations, conditions, standards, and directives for the control of radiation hazards connected with medical diagnostic facilities and therapeutic services.

(Social Security Administration) - The Division of Health Standards of the Community Health Service has worked with BHI, SSA and BRH in formulating regulations, conditions, standards and directives for the control of radiation hazards connected with medical diagnostic facilities and therapeutic services.

(Environmental Control Administration, Bureau of Radiological Health) - Yes. Standards are being prepared for the following: (1) T.V. receivers; (2) microwave ovens; and (3) X-ray equipment used by practitioners of the healing arts.

The T.V. standard has gone to and been approved by the Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC). Standards for microwave and X-ray are in draft and review stages.

Selective Service - No.

Smithsonian Institution - The Smithsonian Astrophysical Observatory (SAO) has filed a report on "Laser Safety Regulations for SAO Satellite-Tracking", dated May 1969.

Tennessee Valley Authority - The Industrial and Radiological Hygiene Branch is responsible for developing and implementing standards for use throughout TVA. A Hazards Control Manual which will include industrial and radiological hygiene standards and practices is being prepared for use by TVA personnel and contractors performing work on TVA projects. We will send you a copy of this manual upon completion. Equipment described in Attachment I is inaccessible to the general public.

Arms Control and Disarmament - "No."

Civil Service Commission - No regulations, standards or instructions have been published by the Civil Service Commission concerning health hazards from any type of radiation.

U.S. Information Agency (Voice of America) - a. Many authorities have investigated electromagnetic radiation hazards in relation to the operation of high-power radar and narrow-beam microwave systems, and it has been generally accepted that a power density not exceeding 10 milliwatts/sq. cm. for 0.1 hour can be tolerated without any observable biological symptoms. Although the VOA operates in the short-wave bands at wavelengths much longer than those used for radar and microwave, we have adhered to this power level, and in fact, operate far below it. In addition, the longer wavelengths of our transmissions are less likely to affect humans and animals because they are physically small compared to the wavelengths used. It is also known that the power of our radiated signals decreases very rapidly as one moves away from the source. For this reason, in recent transmitter plant construction we have generally tried to keep our antennas as far inside the plant perimeter as is practicable, e.g., at Greenville where we have up to 500 KW HF transmitters, most of our antennas are placed 3,000 feet inside the station fence for protection of the public. Beyond such distances, most of the energy has been radiated upward from the ground and should no longer be dangerous to persons or animals under the beam.

b. In order to protect VOA personnel from the high voltage effects (not radiation), transmitters are turned off during maintenance and repair activities and all transmitters are fitted with interlock devices and "grounding sticks" when transmitter repair is required.

(Motion Picture and Television Service) - We have promulgated no regulations, standards or directives for control of radiation hazards.

Veterans Administration - No.

b. Yes. Pertaining to x-ray, radium, radon, and other radiation emitting isotopes, VA has DM&S Manual M-2, Part XI. (EXHIBIT 1). Also, VA Construction Service has established a standard (EXHIBIT 2) used to specify requirements of the protective barriers in construction of the various radiological facilities. These standards have been developed to comply with the requirements of National Bureau of Standards Handbook 76 (EXHIBIT 4). The protective barrier requirements pertaining to construction of facilities for cobalt 60, betatron, and linear accelerator units are not covered by these standards, because normally the barrier requirements for such facilities are developed and furnished to VA Construction Service by a certified physicist.

Post Office Department - a. To a very limited degree - see Attachments E and F for Answer No. 1.

b. In reality, this is not applicable at the present time. Authority is existent for the installation of comprehensive medical units but funds are non-existent at the present time for implementation.

# APPENDIX 5

## REPLIES TO QUESTION 3

The following is a summary of the replies to Question 3 as provided by the departments and agencies queried. The detailed materials and supporting documents referenced in the replies are on file in the Bureau of Radiological Health.

QUESTION 3. How does your agency enforce the regulations, standards, directives, etc., reported in Question 2, or insure compliance with them?

Briefly describe enforcement procedures, organization, and methods. If possible indicate degree of effectiveness.

State Department - Directives are enforced through frequent inspections by medical and safety personnel and, if found necessary, by administrative action. Personnel need little if any prompting to take protective measures as all have a healthy respect for radiation and hazards from radiation.

Treasury Department - (Mint) - All personnel operating equipment that can emanate radiation wear protective badges, which must be in full sight at all times. No problem in enforcing our ruling on this. One hundred percent effective.

Department of the Army - The Army Medical Department, the U.S. Army Medical Research and Development Command, personnel engaged in the Department of Army decentralized safety management program, and the proponent commodity commands are continuously evaluating equipment, working conditions, and many other phases relative to the safe working environment. The Army's safety and environmental hazard evaluation is constantly being reviewed and updated to meet the ever-increasing demand for a safe working environment.

The safety personnel assigned to major commands and/or facilities inspect their particular elements for compliance with safety requirements. The Surgeon General has a Class II activity - the U.S. Army Environmental Hygiene Agency (USAEHA) which performs the respective surveys for all major Army installations at least once each three years or at an earlier date, if requested. Each command that has radioactive material has a radiation protection officer (RPO). These RPOs have training commensurate with the potential hazard. Each installation or activity must have either an AEC license or a Department of Army authorization to possess radioactive materials. The application for this authority must contain specific information such as: Training and experience of the RPO, a standard operating procedure for control of the potential hazard and a description of the using facility and/or storage area. Each of these applications is reviewed for adequacy by the various commander's safety personnel, and, finally, by the Surgeon General's staff to be sure that they are in compliance with all recognized standard procedures and all Federal regulations (AEC). These procedures apply only to ionizing radiation, however, microwave and laser devices are included in the surveys performed by personnel of USAEHA.

The control methods indicated above apply to the public, when applicable, Department of Army employees, contractor personnel working on U.S. Army installations and military personnel. These apply to ionizing radiation, microwaves and laser, and when possible, all other requirements of the Walsh-Healey Act.

Department of the Navy - (Office of the Chief of Naval Operations) - Enforcement of regulations and standards is achieved through inspection. The organizations inspecting include:

1. Naval Inspector General
   a. Inspects, investigates or inquires into any and all matters of importance to the Department of the Navy, with particular emphasis on readiness, including effectiveness, economy, and safety.
   b. Follows up and follows through on compliance with directives and instructions issued by the Chief of Naval Operations or higher authority.
   c. Additional procedures are contained in SECNAV Instruction 5430.57B (enclosure (5)).
2. Board of Inspection and Survey
   a. U.S. Navy Regulations 1948 Chapter 20 Section 2 applies (enclosure (6)).
   b. The Board of Inspection and Survey conducts Acceptance Trials and Material Inspections of ships and aircraft.
   c. The Board reports all defects or deficiencies noted during inspection, including radiation hazards, to the Chief of Naval Operations and the Chief of Naval Material and Fleet Commanders-in-Chief who insure correction of defects and deficiencies.

(BUMED) - The direct administration of the Radiation Safety program within the Navy is inherently a responsibility of the individual commands. The commands are provided specific safety guidelines by applicable instructions. Radiation Health Officers are assigned to Submarine Tenders. The Naval Shipyards conduct their photodosimetry and radiation safety programs within the Industrial Hygiene Departments. All activities possessing radioisotopic radiation generating equipment are required to appoint a Radiation Safety Officer.

The Radiological Safety program appears to be extremely effective as evidenced by the small incidence of reported overexposures. The Navy processes approximately 40,000 film badges per month. The incidence of reported overexposures (3 rem or greater per quarter) seldom exceeds more than 2 reports per month.

Implementation of the Bureau of Medicine and Surgery Safety program is accomplished by on site inspections, promulgation of safety standards, situational reporting, annual reporting, and by authority delegated by the Surgeon General of the Navy. These control procedures apply to ionizing radiation programs. Hopefully, this capability will be extended to the LASER and microwave programs through the development of an Environmental Hygiene Survey capability.

(NAVELEX) - Formal safety inspections are part of the procedure for approving the installation of equipment. In all such procedures, safety provisions are spelled out as line items in a contract or instruction. Continued enforcement of safety provisions is the responsibility of the individual ship or station Commander.

(NAVSUP) - NAVSUP enforces enclosures (1) and (2) by frequent inspections. Most NAVSUP field activities issue their own Instructions and/or Directives concerning safety and health situations. All areas where radiation material is stowed by NAVSUP activities have warning signs and the containers have labels indicating the potential radiation hazards.

Department of the Air Force -

A.1 The enforcement of regulations and technical orders is delegated by AFR 122-1 to the Inspector General for Nuclear Safety, Kirtland AFB, New Mexico.

A.2 Enforcement of standards, regulations, technical orders, etc., is delegated by AFR 122-1 to the Inspector General for Nuclear Safety, Kirtland Air Force Base, New Mexico.

B.1, B.3 Enforcement of directives and technical orders is the responsibility of the Inspector General, USAF.

B.2, B.1 If standards existed, they would be enforced by the Inspector General, in accordance with AFR 20-68.

B.4 Regulations are enforced by local commanders. Compliance is checked by Headquarters elements. A separate checking system is vested in the various Inspector General offices in these same headquarters and at Hq USAF level. Inspector General responsibilities and activities are covered in AFR 20-68. Monitoring and surveillance is an integral part of the Occupational Medicine program conducted in accordance with AFM 161-2 and surveys accomplished by the Ground Electronics Engineering-Installation Agency.

B.5 If standards existed for radio and low frequency non-ionizing electromagnetic radiation, they would be enforced by the Inspector General, in accordance with AFR 20-68.

B.6 Directives are enforced by local commanders and compliance is checked by Headquarters elements. A separate inspection and compliance system is enforced by the USAF Inspector General, in accordance with AFR 20-68.

Department of Justice - Our agency (Bureau of Prisons) insures compliance with the standards for x-ray machines by following through on the recommendations by the Bureau of Radiological Health, USPHS. We also visit each station annually and review implementation of these recommendations.

Department of Interior - Enforcement of safety and health standards, etc., in the Bureau of Reclamation is the primary responsibility of the supervisors, who, in turn, are responsible to their respective operating office heads. A comprehensive Bureau-wide safety program, incorporating provisions for safety training, safety inspections, accident reporting and investigation, etc. insures compliance with Reclamation's health and safety requirements. The Bureau's safety organization is administered by a Chief Safety Engineer and a staff of 30 full-time safety officers.

Bureau of Reclamation contractors are required by contractual obligation to comply with the safety requirements set forth in "Construction Safety Standards," which incorporate the specific provisions noted under Question No. 2 (above). Reclamation construction contracts also require compliance with Federal, State, and municipal safety and health statutes and codes (refer to Paragraph 8, Safety and Health, General Conditions of Reclamation contracts - copy enclosed as Attachment B).

With regard to the radioactivity standard for receiving water which is currently under development, the Federal Water Pollution Control Administration will have the authority of direct enforcement only in situations involving interstate waters. If the occasion for enforcement action should arise, the procedure is one of escalation proceeding from private discussion with interested parties through an enforcement conference to a hearing at which testimony is presented under oath. Once the radioactivity standard has been accepted and is in force, compliance will be checked through the radiological monitoring activities of the FWPCA (national surveillance network and short-term intensive studies), other Federal agencies, and the States.

(Bureau of Mines) - Public (Statutory). Enforcement of standards is not being pursued pending their validation which is 1 year following final publication in the Federal Register. When enforcement is pursued, it will be through the efforts of the Bureau's organized Health and Safety mine inspection force in accordance with Sections 8 and 9 of the Federal Metal and Non-metallic Mine Safety Act. See Enclosure 1.

Bureau Personnel. Enforcement responsibility is assigned at each Bureau organizational level. All projects involving ionizing radiation must be reviewed and granted approval by the Assistant Director - Planning prior to start of operations. Review covers location of workplace, construction, layout and design of equipment, and facilities, and proposed operating procedures. Periodic inspection of facilities for compliance with health and safety regulations by safety engineers and health physicists. Designation of Radiation Protection Officers at each location to apply the provisions of the regulations locally. See 395 BM 20.5 A, B, C, and 7 A, Bureau of Mines Manual, "Protection Against Ionizing Radiation," Enclosure 3.

Department of Agriculture - The Administrator, Agricultural Research Service, has appointed a Radiological Safety Committee (RSC) and a Radiological Safety Officer (RSO) whose responsibilities and functions are specified in AM 210.14. Through rules and procedures established by the RSC and RSO, strict "paper" control is exercised over the procurement and use of radioactive materials and/or radiation emanating equipment. Upon approval of the RSC, qualified users are responsible for the safe use of radioactive materials and/or radiation emanating equipment by themselves and by persons under their supervision. In some of the larger laboratories the RSC has appointed a local Radiation Protection Officer who oversees the safe use of materials and/or equipment and reports to the RSC and the RSO. The RSC also has the authority to deny the use of radioactivity and/or radiation emanating equipment should its use be uncontrollable to the extent that the user or the general public might be exposed. The Committee exercised this authority on two occasions. Further, the RSC has the authority to revoke the use of radioactive materials and/or radiation emanating equipment if not used in accordance with prescribed rules and safety procedures. The Committee has not found it necessary to do this, however, as all RSC approved users have been very cooperative and are themselves interested in radiation safety. Finally, visits are made by members of the Radiological Safety Staff to inspect facilities for compliance and to offer advice as may be required.

Although the activity Safety Officer acts in an advisory capacity, enforcement of any safety regulation is the function of the line supervisor. However, compliance by scientists is normally obtained by convincing explanations rather than by enforcement procedures.

(Forest Service) - Enforcement is by inspection and by training of personnel concerned. For example, all radiological monitor instructors must have a certificate of the required training and be licensed or authorized by the Department of handle radioactive materials. Since this deals with our own employees only, effectiveness of control is very high.

Our FPL personnel who use material that can produce harmful radiation without wearing a safety badge are to be reported to the Director immediately. Also, all work involving use of such material or equipment must be cleared through the Lab Radiological Officer. He therefore, has knowledge of use and can monitor compliance with directives.

To date the system has been very effective.

Department of Commerce:

(National Bureau of Standards) - See Radiation Safety Manual; health physics program.

(Environmental Science Services Administration) - Enforcement by Regional Headquarters staffs.

(Maritime) - N.A.

Department of Labor - N.A.

Department of Housing and Urban Development - "No."

Agency for International Development - "N.A."

Department of Transportation - The responsibility for enforcement and compliance with the DOT regulations for transportation of hazardous materials, including radioactive materials, remains primarily within each of the four operating administrations which has jurisdiction over its particular mode of transportation. Each administration has its own force of field inspectors who devote a small portion of their time to the hazardous materials area.

Atomic Energy Commission - The AEC has made health and safety a line management responsibility extending from the General Manager, who discharges the administrative and executive functions of the AEC through the field office manager to the contractor who operates a facility for the AEC. This recognition of safety as a primary management responsibility is consistent with the basic premise that the health and safety aspects of an operation cannot be isolated and treated differently from other management considerations, such as cost, performance, and scheduling. Accordingly, the AEC has spelled out in detail the assignments of responsibility for safety at all levels of management.

The assignment of each field office manager includes the following statement:

> "Within the scope of delegated authority and assigned functions, field offices must assure that appropriate consideration is given to the protection of the health and safety of Government and contractor personnel and of the general public from the hazards associated with assigned functions."

The field office manager, in turn, continues to emphasize the inherent management nature of the health and safety responsibility by inserting in each operating contract the following clause:

> "The contractor shall take all reasonable precautions in the performance of the work under this contract to protect the health and safety of employees and members of the public and to minimize danger from all hazards to life and property, and shall comply with all health, safety, and fire protection regulations and requirements (including reporting requirements) of the Commission. In the event that the contractor fails to comply with said regulations or requirements of the Commission, the Contracting Officer may, without prejudice to any other legal or contractual rights of the Commission, issue an order stopping all or any part of the work; thereafter, a start order for resumption of work may be issued at the discretion of the Contracting Officer."

The AEC field offices assess the health and safety performance of their contractors in accordance with management directives. (Note attached Manual Chapter 0504, "Operational Safety Program Appraisals.") The contractor appraisals performed by field offices are designed to:

a. determine compliance with AEC policies and requirements;
b. evaluate the health and safety programs of the contractor, insuring that proper steps are being taken to protect the employees, the general public, and property;
c. provide advice and assistance in existing programs or establishing new programs to assure that the AEC's health and safety requirements are met; and
d. anticipate program changes to meet new or unusual health and safety problems in the future.

Each formal contractor appraisal visit culminates in a review of the findings and recommendations with the plant manager or his representative, and appropriate reports covering these recommendations are submitted to the contractor management.

In addition to the surveillance activities described above, the AEC's Division of Operational Safety and Division of Inspection independently monitor for the General Manager and the AEC the effectiveness of the policies and procedures. Selective inspections are conducted at the contractor, field office, and Headquarters level to provide sufficient data to reach a conclusion as to performance adequacy at each echelon in the organization.

Civil Aeronautics Board - "N.A."

District of Columbia Government - Public health regulations are enforced by the D.C. Department of Public Health, Radiological Health Division.

Registration of radiation sources. The Radiological Health Division receives information from contractors, architects, U.S. AEC, and suppliers of x-ray equipment, of new users of x-ray devices or radioactive material. The owners are then contacted and followed up until all sources are registered. Of those radioactive installations located, registration has been 100% successful.

Hospitals. The radiation equipment and associated facilities are inspected annually to determine compliance with the Department's hospital regulations. Except for certain minor deficiencies, compliance has been excellent with all hospitals meeting the minimum standards.

Physicians and podiatrists that apply to the Department for authority to provide Medicaid Services under Title XIX, are not approved for x-ray or radioisotope services unless the Department's radiation protection standards are met. Compliance has been 100% for all providers.

Other physicians, chiropractors and dentists who do not apply or are not eligible to apply under the Medicaid program are encouraged to comply with the Department's standards on a voluntary basis. This phase of the Department's radiological health program has met with little success. Some radiation users refuse to permit inspections or follow-up visits. Less than 35 % of the inspected radiation users make any effort to comply with the inspector's recommendations. Over 80% of the facilities fail to meet minimum standards. The agency has encountered considerable difficulty with suppliers of x-ray equipment. Many have failed to notify the Department of leases or sales of x-ray equipment; approximately 10% of the machines sold in the District and 60% of the leased equipment fails to meet minimal safety standards. Some companies deliberately remove safety devices in an effort to underbid reputable suppliers.

Enforcement of radiation standards on District of Columbia personnel and contractors is through interagency voluntary agreements. Within the Department of Public Health users of ionizing radiation are inspected annually or biannually and reports of findings are followed up to assure compliance. This has met with fairly good success, but is dependent upon the cooperation and support of many programs within the Department. Efforts have been made to require all requisitions for radiation sources to be routed through the Radiological Health Division to permit an evaluation of specifications, but this has not been supported at all levels.

The compliance of other D.C. Departments with the radiation standards is dependent upon the voluntary support of the department head, and results are available.

Federal Communications Commission - "N.A."

General Accounting Office - "No."

Interstate Commerce Commission - As indicated in the response to Question 1, the Commission indirectly enforces regulations which bear on the control of health hazards to the public by means of our decisional process in application proceedings. The Commission's power to deny applications by reason of proven non-compliance with DOT's E&ODA regulations indirectly supports the enforcement of DOT's regulations.

National Aeronautics and Space Administration:

(Ames Research Center) - The enforcement of these Center regulations is accomplished through spot inspections by the Safety Office and various members of the Radiation Safety Committee, as well as the regular monthly contractor-conducted laboratory area contamination surveys. Several of the procedures in the normal usage of radioactive materials make is possible to keep constant checks on the user for compliance with these regulations, (Enclosures C, D, E, F, G, H, I, J, K, L, M). The degree to which our regulations are observed by the users of radioisotopes, x-ray machines and accelerators has been very good. Occasionally we find a violation, but estimate approximately 90% in compliance. Before the recent Laser Survey performed by Mr. David Sliney of the U.S. Army Environmental Hygiene Agency, a very low figure could be given for the compliance with laser usage regulations. We feel this figure has radically changed upward.

(Electronics Research Center) - At the present time, enforcement of these policies rests with Center management. The program is considered to be effective, and is monitored by the Health and Safety Officer and the industrial hygiene contractor personnel.

(Flight Research Center) - Enforcement by inspections and measurement, two safety groups, and the Safety Office (Attachment (1) shows the FRC Safety organization).

(Manned Spacecraft Center) - Enforcement of the standards is accomplished by periodic surveys and/or studies performed by the Occupational Medicine Program Office.

(Langley Research Center) - Items listed under A and B fall under the jurisdiction of the Subcommittee on Radiation Safety (Attachment 3). This organizational setup has been very effective at Langley Research Center.

(Lewis Research Center) - To ensure protection of personnel from radiation we have, as part of our organizational structure, a Health Physics Section which is under the direction of a professional health physicist. This group is responsible for originating and enforcing procedures or standards for proper handling of radioactive sources and materials. These procedures are continually being updated and improved. The proper procedures for the various situations involving radioactivity are made available to appropriate personnel in the form of Health Physics Bulletins.

The standards are enforced by periodic reviews and surveys by members of the Health Physics group. In addition film badges (for personnel and area) are processed on a periodic basis to assure that personnel exposure and radiation levels are within acceptable limits.

On the basis of experience to date, the procedures, organization and methods appear to be operating in an effective manner.

(Jet Propulsion Laboratory) - The enforcement of safety is a line responsibility and the manager of each section in our organization is directly responsible to see that persons under his jurisdiction adhere to all safety rules. The Safety Manual covers this organization. The Safety Office makes a semi-annual review of the section's performance.

(Mississippi Test Facility) - In the medical services operation, the diathermy unit is operated in accordance with instructions by management supervision.

In the Lab operation, work is performed in specially isolated areas, or work area is roped off with unauthorized persons kept out. The work area is also posted with signs signifying radiation danger. Violations are dealt with by Safety and/or Management. Effectiveness completely satisfactory.

Regulations are enforced as follows by contractor (GE): Work is done in specially isolated area, or work area is roped-off and unauthorized persons are kept out. Work area is posted with signs signifying radiation danger. Violations are dealt with by Safety Department and/or management. To date, effectiveness has been completely satisfactory.

By contractor (North American Rockwell), only qualified NAR personnel are used with 100% monitoring by Safety engineer. The degree of effectiveness is considered excellent by the Company.

Adequate surveillance is maintained by MAF and/or MSFC personnel through spot checks and surveys to assure compliance with NASA/MSFC/MAF approved contractor procedures. These procedures are considered adequate to control the radiation health hazards at this installation.

(Michoud Assembly Facility) - Boeing: Line supervision is responsible for enforcement of safety standards at Boeing-Michoud. In this plan, as stated in Boeing Administrative Procedure 632, "Control of Industrial Hazards," the shop supervisors are responsible for the safety of employees and property under their supervision. Therefore, the supervisors are expected to be familiar with the necessary safety documentation in order to enforce company regulations. The Boeing Health and Safety Organization serves as an advisor to supervision and also monitors various operations to ensure adequate compliance with safety criteria. Health and Safety Radiation Monitors have complete authority in the event of noncompliance with radiation safety standards.

Chrysler: Enforcement of the instructions and procedures outlined in subparagraph 4(a)(2) above is effected through the use of, and strict compliance with, the attached "Permit to Use Source of Ionizing Radiation" form and "Recommended Safety Regulations to be Followed in Low-Powered He-Ne Lasers."

Mason-Rust: By ascertaining that only qualified personnel operate these machines, and in the case of the X-ray machine and television receiver, the area of operation is isolated from general traffic. Warning signals are in effect when the equipment is in operation.

Service Technology Corporation, TS Division: A negative report is submitted with the exception of a (white light) device that is used on each of the five oscillographs that are located in our Data Reduction area. Each of the oscillographs is equipped with a protective cover. To our knowledge, the amount of radiation is not extensive enough to warrant elaborate procedures. The only protective measure deemed necessary is to provide safety glasses to prevent sunburn to the eye over a long exposure time. All personnel associated with the oscillograph are informed of this and act accordingly.

(Goddard Space Flight Center) - The Goddard Space Flight Center has a continuing program of radiological surveillance. Responsibility for the success of the health and safety program rests ultimately with the Director, GSFC. However, primary responsibility for the protection of GSFC personnel and property and for the identification and control of hazards rests with the same line management charged with the success of GSFC's programs.

The Director is assisted in the implementation of the GSFC health and safety program by the Health and Safety Protection Review Council (H&SPRC) which reports to the Director. The H&SPRC is composed of the seven (7) Assistant Directors and the Chairman is the Associate Director, GSFC. The function of the Council is to provide a periodic review of the GSFC health and safety program; developing and implementing an overall health and safety program for the Center; and approving policies and procedures which implement the entire spectrum of such a program.

Five (5) permanent committees have been created to advise the H&SPRC on specialized matters of personnel and equipment protection. Please refer to Tab F, Part III of this report for additional information concerning the mission and composition of the council and its committees.

The H&SPRC is assisted in its radiological safety function by the GSFC Radiation Safety Committee (RSC). The RSC is composed of members familiar with the health and safety aspects of the equipment peculiar to their organization (e.g., xenon lamps, radionuclides, laser, microwave, x-ray, etc.). RSC members are also relatively senior representatives of their respective organizations. The RSC will attempt to resolve all health and safety problems as they arise (e.g., violations of GSFC regulations, exemptions from GSFC regulations, recommendations of new or amendments to existing regulations, etc.). The Committee has the authority to approve programs from a radiation point of view and to approve personnel as responsible users and custodians.

The RSC is assisted in its function by the Health and Radiological Protection Office (H&RPO). It is the function of the H&RPO to provide technical competence in the specialized areas of ionizing and non-ionizing radiological protection. To this end, H&RPO will recommend to the committee applicable guidelines and standards (see, for example, Part III, Tab E); prepare and up-date the GSFC Radiological Safety Handbook (Part III, Tab A); assist in the preparation and subsequent up-dating of the GSFC Health and Safety Manual (which is currently in preparation); providing special qualification courses and testing of radiation workers as required (see Part III, Tab G - "Irradiator Operators' Approval Information" and Part III, Tab H - "Development of Course Material for Laser and Microwave Hazards Briefing").

The control function of the H&RPO is exercised by the Radiological Safety Officer (RSO). When violations of GSFC regulations are noted a formal "Radiation Incident Report" (GSFC 23-37) will be issued by the RSO as noted in Part III, Tab I. Depending upon the gravity or potential gravity of the infraction a "full-scale" investigation may take place culminating with a hearing before the RSC. Although, the RSC may resolve the case, it may also cause the H&SPRC to be convened and render the final resolution with the only recourse of the violator then being to the Center Director. This compliance program has been very effective.

A Facility Operations Manager (FOM) is designated by the Chairman of the H&SPRC for each GSFC building or facility. The FOM has overall responsibility for all matters affecting the safety of that building or facility. The FOM will carry-out his responsibility in such a manner that the implementation of the health and safety program is accomplished by line supervisors of the organizations resident in his facility. He will seek and shall receive technical information, recommendations and counsel from the professional health protection personnel of H&RPO. The FOM is generally the senior management representative in the building or facility and serves as the focal point with H&RPO concerning the Occupational Medicine and Environmental Health which includes Radiation Safety.

Peace Corps - "N.A."

General Services Administration - "N.A."

Health, Education, and Welfare:

(Food and Drug Administration) - FDA has responsibility for the program in the Isotopes Committee and enforced by the Radiological Safety Officer. Scientific investigators planning to use radioactive materials are required to apply to the Isotopes Committee for approval. The safety program includes periodic inspections of FDA facilities wherein radioisotopes and/or radiation generating devices are being used. Where appropriate, users of radioactivity are monitored with film dosimeters and radiation survey instrumentation.

(National Institutes of Health) - NIH enforces the provisions of their Radiation Safety Guide by means of inspections and systematic training of personnel. Deviations from standards are reported to the Radiation Safety Officer who is supported by the Radiation Safety Committee.

(Health Services and Mental Health Administration) - HSMHA under the Medicare Program enforces statutory requirements of Section 1861 (J) of the Social Security Act. Institutions under Medicare are licensed pursuant to State laws and regulations pertaining to radiological health. Institutions not in compliance may find that the State agency can recommend to the Secretary (DHEW) that the institution or supplier be denied certification, and reimbursement for its services be discontinued. The Regional Medical Programs Service enforce the radium loan agreement by reviewing the compliance with the conditions of the loan. Non-compliance is cause for revocation of loans. Federal Health Programs Service and Indian Health Service provide surveys at least biannually to determine existing conditions and compliance with established policy.

(Social Security Administration) - A provider of diagnostic facilities and therapeutic radiological services qualifies for reimbursement under Medicare when he complies with the conditions of participation and certified by the State agency.

(Environmental Control Administration, Bureau of Radiological Health) - Enforcement of regulations is obtained by issuance of stop-sales directive from the ECA after inspection by members of the BRH Compliance Office.

Companies receiving such a directive will comply immediately and in some instances will also notify distributors to stop their sales and to return to the company all unsold product inventories. The Bureau approves the letters of notification that are sent to distributors and also conducts any follow-up action. In follow-up action the Bureau contacts all necessary parties such as State radiation control agencies, etc., and informs them of the situation.

Selective Service - N.A.

Smithsonian Institution - With respect to the question about authority within the Smithsonian for control of hazards from electronic product radiation, the Occupational Health Medical Officer was given responsibility in 1963 for broad health programs, in collaboration with the Safety Management Officer. On July 28, 1969, a three-man Radiation Control Committee (see attached) was created in response to the Radiation Control Act. A radiation policy will be developed as a guide for handling radiation producing materials and products in the Smithsonian Institution.

Tennessee Valley Authority - Adherence to approved standards and regulations is primarily the responsibility of the division, branch, or staff utilizing the electronic product or radioactive source; the responsible group is therefore required to have standard operating procedures. The Industrial and Radiological Hygiene Branch performs periodic surveillance of the equipment or facilities to assure conformance to such standards. This approach has been very effective thus far.

Arms Control and Disarmament Agency - "N.A."

Civil Service Commission - "N.A."

U.S. Information Agency:

(Voice of America) - For protection of operating personnel against high voltage, i.e., against touching hot spots such as guy wires, high potential groundings lugs, charged capacitors, etc., directives and instructions have been issued to each transmitting station manager. However, we have not issued directives regarding possible radiation hazards because no official safety standards have been established for the high frequency portion of the radio spectrum. Field strength measurements and power density calculations at a typical VOA high power transmitting station (Greenville, N.C.) indicate that we operate below the safety level of 10 mw/sq.cm. Noting the lack of a universally accepted radiation safety standard, this Agency has participated in a year-long research study with Ark Electronics Corporation of Willow Grove, Pennsylvania and Temple University Health Sciences Center in an attempt to examine some of the parameters involved in high frequency radiation hazards. A copy of our final report has been made available to your office (to Dr. William Mills of the Bureau of Radiological Health).

(Motion Picture and Television Service) - We have no regulations.

Veterans Administration - Pertaining to Manual M-2, Part XI -- In compliance with paragraph 2.10 of the Manual (EXHIBIT 1), Hospital Directors are responsible for assuring that practices and procedures prescribed in the Manual receive compliance. As required in paragraph 2.06(a), the physician or dentist in charge is responsible for the protection of personnel against radiation and electrical injuries and for the execution of instructions pertinent to regulations for all employees. Pertaining to VA Construction Service standard (EXHIBIT 2) -- In construction of new facilities, the resident engineer sees that the requirements stipulated on work drawings receive compliance. Specially designed facilities for cobalt 60, betatron, and linear accelerators are inspected and accepted by a certified physicist, usually the one that developed the original requirements (EXHIBIT 3). Before the Atomic Energy Commission gives approval to operate a cobalt 60 unit and before the manufacturer can furnish the cobalt source, the Atomic Energy Commission must be furnished with the physicist's report and work drawings to indicate that the facilities have been properly constructed (EXHIBIT 12).

Post Office Department - The Postal Inspection Service serves as the eyes and ears of the Postmaster General and its mission encompasses many broad and general areas. Included in the long list of assigned responsibilities is the following from the Postal Manual:

> "Directs the execution of policies, regulations, and procedures governing all investigations, including presentation of evidence to the Department of Justice and U.S. Attorneys in those of a criminal nature, and directs operating inspections and audits for the Postal Service."

If a postal inspector should observe a health hazard or be informed of one during an inspection of a postal facility, he would take immediate steps to remedy same. For example, note information contained in Attachment F for Answer No. 1.

Government Printing Office - "Not applicable."

BLANK PAGE

# APPENDIX 6

## REPLIES TO QUESTION 4

The following is a summary of the replies to Question 4 as provided by the departments and agencies queried. The detailed materials and supporting documents referenced in the replies are on file in the Bureau of Radiological Health.

QUESTION 4. What control procedures, as distinguished from regulations or standards, are employed to control health hazards to the public and to agency and contractor personnel from the types of radiation indicated in Attachment I?

Briefly describe such control procedures, the types of radiation to which they apply, and provide a copy of any documents such as procedure manuals, organizational charts, or other materials which are applicable.

State Department - Personal monitoring X-ray badge service is supplied by the Naval Research Laboratories. Radiometers are worn by operators of X-ray machines in addition to the badge. Use of these detectors is as described in the directive covering "Radiological Safety Program", as indicated in 2 (b).

Treasury Department - The equipment used by the Bureau of Customs is all of a low grade radiation type and must be well shielded. Our laboratory employees and administrative personnel carefully follow manufacturers' instructions in the use and control of the equipment and use radiation measuring and control devices on a regular check basis.

(Engraving and Printing) - Sources of ultra-violet light. The Bureau has a number of ultra-violet lamps (both short and long wave-length) which are used in research or for inspection purposes. Users of these lamps are cautioned not to look directly at the source of the radiation. Booths on certain presses have been constructed to facilitate inspection of stamps under ultra-violet light and to reduce stray light. The presses also have monitoring devices with ultra-violet light sources. These units were designed with shields to minimize exposure to personnel to the ultra-violet light. Small detection devices having ultra-violet light in enclosed sources are also on several perforator machines. A number of laboratory instruments depend on sources of ultra-violet light. There is one within the entirely closed ultra-violet spectrophotometers. A dc arc is used to operate a spectrograph. Here shields are used to prevent eye damage. The most intense sources of ultra-violet light in the Bureau are those in the Fade-O-Meters. There is some stray light. Two such instruments are used to test the fading characteristics of pigments and inks. We have had more than twenty-five years experience in operating Fade-O-Meters without any known over-exposure.

Ultrasonic cleaning baths. Two are very low powered baths used by chemists and laboratory technicians cognizant of their proper use. One low powered and one larger unit are used by machinists for cleaning machine parts. No special directive has been considered necessary as the energy is dissipated in the cleaning fluid and not into air.

(Mint) - None.

Department of the Army - All alleged excessive or overexposure to ionizing radiation are required to be investigated by the immediate commander. A copy of these investigations is furnished to the Office of The Surgeon General under the provisions of AR 40-14. Also, a medical surveillance program for lasers users is required in TB Med 379.

Department of the Navy:

(Office of the Chief of Naval Operations) - Control Procedures

1. OPNAV Instruction 5100.8 (enclosure 2) and U.S. Navy Regulations 1948 ar article 0712 (enclosure (7)) apply.
2. Safety precautions and procedures for the control of health hazards are provided by the Chief of Naval Material and the Chief, Bureau of Medicine and Surgery for all equipments, supplies and facilities provided by their respective commands.
3. All commands and activities are directed to:
   a. Take positive and continuing action to insure that all personnel are infused with a thorough knowledge and comprehension of the principles and practices of safety.
   b. Insure that safety precautions and procedures are included and followed in all actions planned or conducted by all commands or shore activities.
4. Commanding officers are required to insure that persons concerned are drilled in all applicable safety precautions and procedures, that these are complied with and that applicable safety precautions, or extracts therefrom, are posted in appropriate places.
5. In the Department of the Navy, the Naval Safety Center is the resposit itory for all safety information - including reports of Boards of Inspection and Survey and reports from commands and activities. The Safety Center:
   a. Initiates and conducts independent investigations and analyses into all phases of safety.
   b. Advises and informs the operating forces and shore activities on safety matters of interest or concern.
   c. Keeps the Chief of Naval Operations advised of the status of Navy safety programs.

(NAVSUP) - In addition to enclosure (2), NAVSO P-2455, NAVSUP Pub 284, NAVMED P-5055, NAVMAT Instruction Series 5101, and NAVSUP Field Activity Control Instructions, e.g., enclosures (3) and (4), contain procedures to control radiation health hazards. Additionally, the quarterly NAVMED 576, Occupational Health Data Sheet is submitted by certain NAVSUP activities, and contains the record of exposures to X-rays, radium, isotopes, etc.

(NAVFAC) - LASER UNDERWATER SURVEYING SYSTEM - Utilized in TEKTITE Program. Safety criteria furnished by manufacturer augmented by a draft of an instruction on laser safety prepared by BUMED, was utilized.

(NAVSHIPS) - Publication of a Technical Manual for Radio-Frequency Radiation Hazards, NAVSHIPS 0900-005-8000, for general information within the Department of the Navy on safe exposure criteria established by the Bureau of Medicine and Surgery and to provide techniques for calculating and measuring RF fields.

RF Radiation Hazard Measurement surveys are made on ships to determine radiation levels in manned areas. Based on these surveys protective measures are taken to assure personnel safety.

Department of the Air Force -

A.1 Control procedures, aside from those mentioned, are an integral part of the public health and occupational medicine program conducted in accordance with AFM 161-2, "Conducting the Aerospace Medicine Program," at each base, station, and operating location of the USAF. It is impossible to describe each in detail or to provide copies since there are well over 400 such installations.

A.2 Control procedures, aside from those mentioned, are an integral part of the military public health and occupational medicine program conducted at each base, station, and operating location of the USAF.

B.1 Control procedures, in addition to those mentioned, are an integral part of the Occupational Medicine and Ground Safety programs conducted at each USAF base.

B.2 General overall control responsibilities are specified in AFM 161-2 which covers the occupational medicine and bioenvironmental engineering aspects of the Aerospace Medicine Program. Surveillance of activities using potentially hazardous devices is required as is the establishment of appropriate safeguards, once it has been determined that a hazard does exist.

B.3 Control procedures, in addition to warning notes in technical orders, are an integral part of the Occupational Medicine and Ground Safety programs conducted at each USAF base. Chapter 4, AFM 161-2, provides a description of this Occupational Medicine Program.

B.4 Two USAF Surgeon General policy letters have been disseminated to major commands, requiring a complete survey of all microwave ovens (reference paragraph B4 2(7)(8). Microwave generator site commanders are responsible for the operation of radar equipment and also have primary responsibility for the safety of their men. The Ground Electronics Engineering-Installation Agency provides indoctrination and periodic on-the-job training in radiation hazards safety. A training film on radio frequency hazards has been produced to aid in this program.

B.5 General overall control responsibilities are specified in AFM 161-2 which covers the occupational medicine and bioenvironmental engineering aspects of the Aerospace Medicine Program. Surveillance of activities using potentially hazardous devices is required as is the establishment of appropriate safeguards, once it has been determined that a hazard does exist.

B.6 Control procedures, aside from those mentioned, are an integral part of the occupational medicine program conducted at each Air Force base in accordance with provisions of AFM 161-2. Consultant services of qualified USAF Medical Service personnel, to insure proper certification of each laser/maser installation, are available from USAF Environmental Health Laboratories, the USAF Radiological Health Laboratory, and the USAF School of Aerospace Medicine (USAFSAM). Considerable research on biomedical effects of coherent light has been, and continues to be, accomplished by the USAFSAM.

C.1 General overall control responsibilities are specified in AFM 161-2 which covers the occupational medicine and bioenvironmental engineering aspects of the Aerospace Medicine Program. Surveillance of activities using potentially hazardous devices is required, as is the establishment of appropriate safeguards, once it has been determined that a hazard does exist.

C.2 Control procedures, aside from those mentioned, are an integral part of the occupational medicine program conducted at each Air Force base in accordance with the provisions of AFM 161-2. Considerable research on bioacoustics has, and continues to be, accomplished by the 6570th Aeromedical Research Laboratory, Wright-Patterson Air Force Base, Ohio. The USAF School of Aerospace Medicine also maintains a repository of all auciometric examinations accomplished on Air Force personnel and each installation Director of Base Medical Service continuously evaluates the significance of any threshold shift identified following audiometric examinations.

C.3 Control procedures in addition to those mentioned, are an integral part of the Occupational Medicine programs conducted at each base under the provisions of Chapter 4, AFM 161-2.

Department of Justice - Generally the Department of Justice does not employ equipment that emits an identifiable hazardous level of radiation. For example, although the FBI laboratory does have equipment that emits radiation to some minor degree the personnel who operate the equipment, while thoroughly knowledgeable, are afforded annual physical examinations which have never indicated any overexposure to radiation. The FBI's experience with the radiation level of their laboratory and radio equipment is not considered such as to necessitate a detailed control system to further ensure control of health hazards from electronic product radiation.

The Bureau of Narcotics and Dangerous Drugs has filed applications for By-product Material License with the Atomic Energy Commission, Isotopes Branch, Division of Licensing and Regulation, for the type of material described in Number 7 below. Specific instructions are being prepared for handling and cleaning radioactive material. The instructions will be based on those developed by the Food and Drug Administration, copy attached.

(Bureau of Prisons) - Control procedures include monitoring by the use of occupation x-ray badges from the Eberline Instrument Corporation (a contractor of the Bureau of Radiological Health, U.S. Public Health Service). This includes monthly reports of all people taking x-rays. When a badge shows any abnormal reading, a telegram is sent immediately to the institution and an investigation is begun to determine the cause.

A six year study on "noise and hearing" was conducted by the Division of Occupational Health, U.S. Public Health Service, in several prison industries. A copy of this study is attached.

Department of Interior - Each agency indicated that the control procedures employed are consistent with the safety instructions and precautions recommended by the various manufacturers of the radiation emitting equipment used. To protect the general public, equipment considered to be potentially harmful is usually located in areas which are restricted or inaccessible to the public.

The Bureau of Reclamation controls the operation of radar sets in the following manner:

> "The military safety level of 10 milliwatts per centimeter power density is adhered to in all instances, and each new type of equipment is monitored to verify its danger area. The general public is not exposed to radiation hazards unless escorted to the proximity of operating equipment by trained personnel."

The Bureau believes that adherence to this control procedure has been successful in the prevention of injurious exposures.

(Bureau of Mines) - Public (Statutory). The primary recommended procedures for control of radon-daughters in uranium mining are: (1) radon-daughters monitoring, (2) adequate volumes of uncontaminated ventilating air to dilute contaminates areas, (3) airborne dust control, and (4) "no smoking".

Bureau Personnel. Control procedures apply to the types of ionizing radiation listed under Sections A1 and A2, Attachment I. The provisions apply the principle of time, distance, and shielding; personnel and area monitoring; medical examinations; materials accountability, and required reporting. See Enclosure 3 and Enclosure 12, Form 6-584, Bureau of Mines Radiation Report.

Department of Agriculture - Health hazards are controlled by requiring RSC authorized users to follow procedures as specified in the Radiological Safety Handbook and in specific Administrative, Standard Operating and Emergency Procedures issued by the TSC and/or RSO. Please refer to the Training and Experience and Radiological Safety Requirements for X-Ray Machine up to 110 KVP. All persons using materials or equipment listed in Section A of Attachment I are required to wear film badges furnished by the RSO. These film badges are responsive to X, beta, gamma and neutron radiation. All users are required to have minimal training and experience and appropriate facilities, equipment and instrumentation before they can independently use radiomaterials and/or radiation emanating equipment.

The RSC also has a procedure for procuring radioactive materials and/or radiation emanating equipment as specified in Sections II and III of AM 210.14. After RSC approval is granted for the purchase, the purchase order itself is processed by the RSO. At that time the RSO furnishes appropriate receipt and disposal forms which must be properly completed by the authorized user when he receives and subsequently disposes of radioactive materials and/or radiation emanating equipment. See attached OA Form 2 and OA Form 3. These completed forms must then be returned to the RSC. Accurate inventories on materials and equipment are maintained at all times.

Control procedures governing health hazards are achieved primarily by the senior scientist responsible for use of equipment familiarizing himself with the hazards involved and training his employees accordingly. Personal protective equipment is used as the need indicates.

(Forest Service) - We have no other control procedures employed (other than normal regulations and standards for use). Our FPL does have a safety committee to control possible health hazards to the public and agency and contractor personnel. This committee makes periodic inspections and investigates potentially hazardous situations.

Department of Commerce -

(National Bureau of Standards) - See Radiation Safety Manual.

(Environmental Science Services Administration) - Laser Hazards Special Study No. 42-50-68/69 on Laser Geodimeter.

(Maritime) - N.S. Savannah contractors requested to supply information.

Department of Labor - "N.A."

Department of Housing and Urban Development - Perhaps an explanation of our negative replies would be helpful as we do not wish to convey the impression that the Department has no concern for environmental health hazards. On the contrary, we have, through the years, developed and maintained several volumes of architectural guidelines which are regarded as basic documents by the home building industry. Included among these are numerous references dealing with fundamental protection measures to make the home a safe place to live. Unfortunately, none of them involve the radiation problem.

Aside from being unaware of this relatively new hazard together with the absence of any existing guidelines, we find ourselves in the handicapped position of being unable to enforce such regulations, even if they did exist, because of the nature of our business--municipal loans, subsidies, mortgage insurance, etc. For example, it would be obviously infeasible for us to legislate and attempt to enforce regulations controlling the design and production practices of television receivers, cosmetic lamps, or microwave dryers. We have no requirements to purchase these items nor do we insure their installation as part of the mortgaged property. Thus, we can assume no direct responsibility for their use. I trust this logic will obviate any thoughts of our lack of concern.

Department of Transportation - (See enclosed replies from individual DOT operating administrations, including attachments.)

Agency for International Development - This Agency has no overall control procedures; however, there is little doubt that those responsible for individual field operations exercise some degree of control.

Atomic Energy Commission - The control procedures for categories A-1 and 2 of Attachment I are specific procedures developed by each contractor for his particular operation. Since there are numerous contractors in the program, it would be a considerable and time-consuming task to compile all the documentation. Perhaps, if the purpose was better defined, a simpler approach could be revealed to obtain the information.

Control procedures relating to categories B and C of Attachment I have been reported, to the extent available, in the Annotated Bibliography of Regulations, Standards and Guides for Microwave, Ultraviolet Radiation, and Radiation from Lasers and Television Receivers - USHEW, April 1968. Regarding the question of control, we believe the answer to Question 3 would also apply here.

Civil Aeronautics Board - "N.A."

District of Columbia Government - Control procedures applicable to sources of ionizing radiation have been discussed above. Control of hazards from non-ionizing radiation is the responsibility of the Division of Industrial Hygiene, D.C. Department of Public Health. Routine inspections are made of some installations using microwave ovens and lasers. Findings are discussed with the users and compliance with recommendations is voluntary. As previously discussed, control procedures are based upon those of the Department of the Army or other nationally recognized authorities.

Federal Communications Commission - "From exposure to discussions in the press, trade journals, and other sources, FCC engineers and the engineers and operators of stations under its jurisdiction are generally aware of electronic radiation hazards, notably X-radiation from high voltage apparatus and electromagnetic radiation generated in high power transmitting and industrial heating equipment. Attached is a page from the engineering manual used by our field enforcement engineers, giving them some criteria for the hazard associated with strong electromagnetic fields. Our Laboratory has several engineers who test microwave diathermy and microwave ovens capable of generating strong fields. These men are warned of the hazard by verbal reminders from their supervisors, and they have available a power meter and small horn antenna with which the intensity of radiation can be measured near these devices. They also make quick checks for excessive radiation by use of neon bulbs and fluorescent lamp bulbs. Numerous types of ultrasonic apparatus are tested for radio interference in our Laboratory. We are aware that high acoustic intensities are present during the test and operation of these devices, but we are not informed of any health hazard criteria which apply to these emanations. We would appreciate any guidance which you may be able to provide. In general, compliance with our technical regulations for suppression of emissions on unauthorized frequencies requires equipment designers to utilize a degree of electromagnetic shielding and filtering which is fortunately more than adequate to satisfy published rf radiation hazard criteria close to the actual equipment. The intense fields of transmitters tend to be found near their antennas; the antennas of the higher power stations tend to be located remote from the station operators and the public.

There is a large area of activity in industrial RF heating and in ultrasonic cleaning, involving sometimes very high power and a wide variety of means of applying energy to the material being treated. The Commission administers programs to minimize the likelihood of radio interference from these devices; however, its regulatory procedures are such that the bulk of this equipment is never seen by our people. There are today possibly more kilowatts of electromagnetic energy devoted to industrial processes than to all radio communications combined. High power non-military radio stations are not greatly expanding, either in number or power, because of the limitations of available spectrum space; they constitute a fairly static hazard, if indeed a practical hazard exists. On the other hand, industrial uses of radio frequency and ultrasonic energy are unlimited in power, number of equipments, and variety of applications, so long as our radio interference regulations are satisfied. Therefore, it is suggested that your agency give a higher priority to the examination and control of hazards in this expanding area, and a lower priority to the matter of radiation from non-military radio stations."

General Accounting Office - "No."

Interstate Commerce Commission - "None."

National Aeronautics and Space Administration -

(Ames Research Center) - The normal visitor control exercised by our Security Office provides for limited or no access by the public to the buildings in which danger from radiation might be experienced. Those employees, both regular and contract, who have access to areas where high-energy radiation is being used, are required to wear film badges and pocket dosimeters where the radiation levels would allow an over exposure within a short period of time, (Enclosures N, O, P). In the area where lasers are in operation, personnel are required to wear proper eye protection. Warning signs, (Enclosure Q), are placed where appropriate to indicate the presence of potential or real danger to health, and interlocks to the laser systems are employed where required. The Safety Office conducts periodic radiation surveys on electron microscopes, accelerators, ultra-violet sources and x-ray machines. Copies of such surveys are attached for your information, (Enclosures R & S).

(Manned Spacecraft Center) - The control of health hazards from all radiation is accomplished by periodic surveys and/or studies performed by the Occupational Medicine Program Office. For example, all microwave ovens at MSC have been surveyed, including quantitative power density measurements, to evaluate personnel hazards from their use.

(Electronics Research Center) - All radiation producing equipment at the Center has been surveyed by consultant groups. For example, all laser equipment was surveyed by a team from the U.S. Army Environmental Hygiene Agency. Recommendations contained in the survey report have been brought to the attention of operating organizations for corrective action.

Attachment #3, for example, requested that all laser safety goggles be labelled to indicate the wavelength attenuation range. Present plans call for the industrial hygiene contractor to survey all areas where laser equipment is used to assure that corrective measures have been instituted. In addition to the laser survey, other radiation producing equipment has been surveyed by the industrial hygiene contractor and found to be adequately protected.

Areas where radiation producing equipment is present are protected by warning signs and red lights and in several cases include electrical door-locking devices. All equipment is surveyed on an annual basis by the industrial hygiene services contractor.

Medical monitoring of employees is an important phase of the program. Employees who are exposed to laser radiation undergo a special medical examination including blood tests, and a complete opthalmological examination complete with fundoscopic photography (See Attachment #4). Personnel who are exposed to ionizing radiation hazards are provided with film badges (TLD type) on a monthly basis which are interpreted by an outside contractor and electronic data reports furnished indicating findings. These individuals are also requested to undergo medical examinations on an annual basis and blood tests made on a semi-annual basis as previously indicated.

There is a safety program in effect which is described in the ERC Safety Guide. The organization consists of the ERC Executive Safety Committee, the ERC Safety Groups, and the ERC Health and Safety Officer. The safeguarding of employees, however, remains a responsibility of line supervision.

(Flight Research Center) - Surveys, posted safety plans, log of operations, monitoring of levels of exposure where necessary, and control of access to test areas.

(Langley Research Center) - On each major facility there is conducted a preoperational review which covers all facets of safety to determine and establish controls and procedures. Experiments also receive a review to establish safe operating procedures (Attachments 4, 5 and 6). Typical parameters and methods utilized are: control rooms, distance, shielding, personal protection equipment, off-shift operation, detection devices, interlocks, signs, audible signals, warning lights, etc.

(Lewis Research Center) - Control of health hazards to personnel is accomplished by: review of operation by knowledgeable health physicist, review of procurement, lectures on radiation safety, material control, written procedures, and radiation detection (via alarms, surface smears, film badges). Our control procedures require that personnel adhere to stipulated procedures, guides, and manuals. Release of radioactive material to the public in any form is governed by accepted limitations (e.g., AEC) and verified for acceptability by members of the Health Physics group. As noted previously, personnel who work with radioactive materials or radiation producing equipment are required to wear personnel monitoring devices (e.g., film badges, dosimeters). Radiation surveys are performed where materials and/or radiation devices are located. The procedures are written in the form of Health Physics Guides and, where appropriate, memoranda. (See Note on page 2.)

In the interest of clarifying our report on the subject study, we wish to point out that the Health Physics Panel, the Special Electrical Applications Panel, the Radiation Safety Committee, and the Area 21 (Plum Brook) Safety Committee, which also serves as the Safeguards Committee for the Plum Brook Reactor Facility, all report to the Lewis Executive Safety Board. The Executive Safety Board has been delegated the responsibility for the Center's overall Safety Program.

At the Plum Brook Reactor Facility these standards and procedures are enforced by directive from the Division Chief. The Health and Safety Office is accountable to him and is responsible for ensuring compliance. Reviews of compliance are conducted by the Safeguards Committee, Radiation Safety Committee, and internal audits. The degree of effectiveness of compliance is high.

(Jet Propulsion Laboratory) - Control procedures are set forth in the JPL Safety Manual as Safety Practices. In this manual there are safety procedures covering potential hazards and the precautions that are necessary. In addition, individual hazardous operations are required to submit operating procedures to cover a single location before operations can commence. (Radiation Safety Manual attached.)

(Mississippi Test Facility) - In the medical service operations, the x-ray equipment is operated only by a trained or certified x-ray technician who is required to wear a film badge for detecting any exposure to ionizing radiation. Other medical personnel with potential exposure danger are also required to wear film badges. The film badge readings are filed for future reference. The x-ray equipment has been inspected and approved by the Mississippi State Board of Health.

In the Lab operation, periodic medical examinations of laboratory personnel are made with respect to x-ray radiation.

By contractor, (GE): Periodic medical examinations of all laboratory personnel are made. These examinations are made with respect to x-ray radiation.

By contractor (North American Rockwell): Control procedures are as identified in the North American Rockwell's instruction MTO I.IA.35. This instruction was identified by NAR but not included in their response. We are attempting to obtain and will transmit them to you as soon as received.

(Marshall Space Flight Center) - (A-1, A-2, B-1 and B-6) Enforcement of regulations relating to ionizing radiation is a function of the Radiological and Isotopes Committee. The Radiation Protection Officer and his staff perform periodic inspections to assure compliance. Other regulations are enforced through assignment of responsibilities to first line supervision and monitoring by the Safety and Environmental Health organizations.

(Michoud Assembly Facility) - Boeing: Boeing does not have a control procedure specifically designed for controlling radiological hazards to the general public. However, all of the radiation regulations apply to employees as well as any other individuals who might be in a hazardous location. Boeing employees are divided into two categories -- radiation workers and non-radiation workers. In any operation on company premises that involves radiation, a barrier is established at a safe distance from the source and only radiation workers are permitted inside the barrier. Primarily, this control technique applies to industrial radiography with isotopes and X-ray machines. However, when small (usually measured in Micro Units) radiation sources are included in various instruments, the sources are periodically tested for leakage as required by Federal and State codes. The dose rate of these sources is measured by instrument to insure the correct size of the isotopes in the instruments before the instruments are initially used.

Chrysler: Control procedures used to control health hazards include "Atomic Energy Rules and Regulations," "Louisiana Radiation Regulations," and "Marshall Space Flight Center Radiation Safety Program."

Mason-Rust: X-ray Unit - The X-ray Department has been certified by radiation physicists in accordance with recommendations set forth by the National Committee on Radiation Protection and Measurements, June 14, 1967. The X-ray equipment technician and immediate environment are monitored by film badge and pocket dosimeters.

As applied to physical therapy - Equipment is operated by trained therapist experienced in the operation and hazards of such equipment.

Television Receiver - This equipment is operated by trained technicain who is monitored by film badge.

(Goddard Space Flight Center) - The GSFC radiological surveillance program centers around: floor plans of each building identifying areas of concern; the "Current Status File," a folder prepared for a particular device or radiation work area; and, the "Laser Hazards Checklist". Copies of sample floor plans; current status files for radionuclide use, x-ray machine, and microwave areas; and, "Laser Hazards Checklist" can be found in Part III, Tab J through N respectively.

All radiation workers are apprised of changes (or the lack of change) within their work areas revealed by H&RPO inspections or surveys. Provisions have been made to provide, upon request, a formal report of these surveys (Health Physics Activity Report", GSFC 23-27; Part III, Tab O). Reports of comprehensive inspections are disseminated to all interested parties, these reports because of their comprehensive nature provide current guidance and training for radiation workers. Two comprehensive inspections of x-ray installations are exhibited in Part III, Tab P. The comments and observations made in the x-ray inspection and radionuclide current status file are indicative of the controls imposed by the Center to prevent unnecessary exposure of personnel.

Control of RF Induction Units has been rather minimal to date because of their uncertain category as a health hazard. However, all users have been contacted and issued copies of: (1) "Serious Accidents" Issue 304 (Second and third-degree Burns from High-frequency Induction Heating Equipment); National Safety Council Data Sheet 319 (Radio Frequency Heating); and, a letter giving H&RPO indorsement to recommendations of these publications. See Part III, Tab R.

The standard being used by GSFC for microwave protection is "Control of Hazards to Health from Microwave Radiation (TB MED 270/AFM 161-7)". A summary of this document is contained in Part III, Tab Q. Additionally, the Manned Flight Support Network has specific safety directives in its operational procedures; and, the STADAN Stations were using, until recently, Air Force TO-31-1-511 which contains basically the same fundamental limit as TB MED 270/AFM 161-7, i.e., 10 $mW/cm^2$.

Interlocking, warning signs and lights; while, not yet completely standardized, has been adequate. Some examples of protective measures used by the stations include: sounding of klaxon horns at the beginning of a radar transmission; flashing warning lights on antennas and access gates to exclusion areas; announcements over the local public address system identifying potentially hazardous areas; lockout key interlocks for maintenance personnel who service the antennas, local operating procedures, which are read by all new personnel; periodic ophthalmic examinations of those potentially exposed; periodic update and refresher training given to operating personnel. Sample RF surveys performed by STADAN personnel to insure the exclusion area adequacy (i.e., no personnel, not in the controlled area itself, may inadvertently be exposed to RF fields in excess of 10 $mW/cm^2$) are included in Part III, Tab S. The standard warning label to be used around RF devices is the USASI standard C95.2-1966. A breakdown of GSFC RF generating equipment by type, frequency, and power is included in Part III, Tab T.

The standard adopted by GSFC for laser protection is "A Guide for Uniform Industrial Hygiene Codes or Regulations for Laser Installations" issued by the American Conference of Governmental Industrial Hygienists; a summary of this document is included in Part III, Tab U.

An initial comprehensive survey of all operational, GSFC lasers was performed in November 1967. A copy of this report is included as Part III, Tab V. The recommendations of the report have been complied with and a "Laser Hazards Checklist" generated by which laser and laser-use information can be continuously updated. The checklist has been referred to previously and is included in Part III, Tab N. The standard laser warning symbol is the "sunburst" design proposed by the Hayden Publishing Company and adopted by the ACGIH, USAEHA, EIA, and many other organizations involved in laser work. The symbol is to be found on part 42 of Part III, Tab U.

The radiological surveillance program receives professional staff support from H&RPO which consists of five (5) professional health physicists, two (2) professional industrial hygienists and six (6) technicians. The H&RPO program includes a radiation safety evaluation of all GSFC sources and devices which may be sources of ionizing (electromagnetic and particulate) or non-ionizing radiation (principally lasers and microwave), as well as the industrial hygiene aspects of electronic devices (e.g., ozone production by xenon lamps, noise levels from rotating machinery, and sonic generators, ultraviolet from solar simulators, etc.) The occupational medicine aspects of the program include pre-employment, periodic and termination physicals as required by the potential hazards involved. This portion of the program is conducted by two (2) doctors, three (3) registered nurses and four (4) technicians. The ionizing radiation surveillance program as carried out by H&RPO is well established and effective. Development and implementation of the non-ionizing radiation surveillance program is receiving increased emphasis.

Peace Corps - "None."

General Services Administration - "In conjunction with the development, coordination, and management of supply supporting services rendered by GSA to the emergency medical activities program of the Public Health Service, GSA handles and services 15 MA X-Ray sets. The guidelines for the conduct of this work are contained in the Public Health Service issuance, "Inspection and Rehabilitation Handbook for Packaged Disaster Hospital Equipment", Health Mobilization Series H-1. (See enclosure 1.) Enclosure 2 is a copy of a memorandum on film badge service.

GSA receives, stores, maintains, and ships some slightly radioactive source materials in the national stockpile program, all of which are covered by the AEC Act of 1954. The control procedures for health hazards under this program are contained in Supplement B to the Strategic and Critical Materials Storage Manual. (See enclosure 3.)

GSA operates maintenance facilities for the repairs, servicing, etc. of cryptographic equipment. This work is performed under classified criteria developed by the National Security Agency and may be obtained from that agency upon meeting security requirements. Also, see item 5, below."

Government Printing Office - The Government Printing Office does use a number of devices which could be classified under the list labeled Attachment I of your letter dated May 27, 1969 on the subject matter. Exceptions to this list are items contained under A1, Radioactive Materials; B5, Radio and low frequency and B6, Coherent electromagnetic radiation produced by stimulated emission.

With reference to radiation to the sonic range, Item C of your letter, the Government Printing Office is complying with the requirements of the Walsh Healey Act. We have recently established a program for conducting periodic audiometric examinations on employees who are subject to sound beyond the maximum acceptable levels. Equipment required to implement this program is in process of acquisition. Based on this Act, we are also establishing a set of sonic radiation standards to be followed in the procurement and operation of printing equipment.

Additional test equipment is being reviewed to provide us with the capability of monitoring existing equipment and new procurements.

On all devices, other than the sonic range, which are listed we do not monitor radiation levels due to the absence of any established standards. It would be prohibitively expensive to purchase sufficient equipment for measuring radiation to levels for which no maximum standards exist.

The Government Printing Office also follows a practice of cautious use of this type of equipment with careful surveys of medical reports on any related effects. We also continue to survey all safety standards which are related to the printing industry.

A copy of a memo dated September 23, 1969, from the Public Printer, Mr. James L. Harrison, to the Chairman, U.S. Civil Service Commission, Mr. Robert Hampton, covering the Government Printing Office's occupational health and safety program is enclosed for your information. The referenced Administrative Order No. 277 covering our Safety Program is also included.

Department of Health, Education, and Welfare -

(Social Security Administration) - After initial certification by State agencies, follow-up visits are made on both a planned and an unplanned scheduled basis. Biannually a review team made up of BHI and CHS staff review the certification operations of the State agencies.

(Health Services and Mental Health Administration) - HSMHA uses all precautions recommended by the American College of Radiology, NBS 76, and the BRH. These are incorporated in the X-ray procedures of the Health Examinations Survey, National Center for Health Statistics. Film badges and surveys by the BRH are also utilized by the Federal Health Programs Service. Personnel working with X-ray equipment receive special safety training. Individuals are encouraged to attend the BRH training courses.

(National Institutes of Health) - NIH uses procedures that involve the proper posting of warning signs, the use of electrical interlocks where indicated, the proper monitoring and calibration of sources used for deliberate exposures, and control procedures involving clearance prior to permitting access to hazardous areas for construction and maintenance. Training courses are presented and information on new hazards is distributed when indicated.

(Food and Drug Administration) - FDA has control procedures in their manual "Guide for Radiological Safety in FDA Facilities." Periodic lectures are given and radiological safety information is transmitted to employees.

(Environmental Control Administration - Bureau of Water Hygiene) - BWH has control procedures for laboratory personnel relating to radioactive sources, ultraviolet radiation, and ultrasonic vibrations. At the entrance doors to virology laboratories equipped with banks of UV sterilizing lamps, red warning lights are illuminated when the UV lamps are burning. Instruction is given to laboratory and maintenance personnel, followed by on-the-job instruction by supervisors.

(Environmental Control Administration - Bureau of Occupational Safety and Health) - BOSH uses a safety committee which conducts periodic evaluation of potential hazards. Industrial hygiene and hazard control training courses are conducted for both agency and non-agency employees.

(Environmental Control Administration - Bureau of Radiological Health) - Each field laboratory has an established radiation protection program which is presented in their Radiation Safety Manual. Each laboratory has a Radiation Safety Committee and a Radiation Safety Officer. All personnel handling radiation sources are monitored by personnel monitoring devices (i.e., film badges). New persons are trained both in academic related subject matter as well as on-the-job. Training of employees is considered to be of paramount importance in controlling potential hazards to people from radiation sources used within HEW.

BRH is concerned with the radiological health science training and manpower needs of Federal, State, and local governments, as well as those in medicine, industry, and education that are required to assure the safe and efficient use of radiation.

In cooperation with the ECA Training Institute three interrelated efforts are operational:

1. Continuing Education - assisting in orientating, updating, and bringing new radiological health knowledge to the man already employed through technical short-course continuing education.
2. More Manpower - increasing radiological science manpower through educational institution traineeship grants, and long-term, short-term, and special training assignments to BRH personnel.
3. New Approaches to Radiological Health Sciences Manpower - through contracts with educational institutions to develop specialized curricula, educational tools, and training methodologies.

The short courses are presented by a full-time staff of specialists in radiological health training, all of whom have at least Master's degrees in radiation science or the equivalent. The teaching staff is supplemented by guest lecturers from other government agencies, universities, and industry. Training techniques include lectures, laboratory exercises, examinations, demonstrations, field visits, group work, and panel discussions. During Fiscal Year 1968, these efforts resulted in the presentation of 81 radiological health courses with a total of 1,932 trainees.

In addition, consultation is provided to other government agencies, State health departments, hospitals, universities, and industry to assist with the development of training programs. Currently, radiological health graduate programs are supported with traineeship grants at 32 schools. These provide for some faculty, equipment, material, and supplies in addition to student stipends and tuitions.

Tennessee Valley Authority - As stated previously, administrative controls are used primarily to prevent exposure to the general public. An example of a control placed on contractors is "TVA's Radiological Hygiene Requirements for Industrial Radiography" (enclosure 2) which is included as part of all contracts awarded for that purpose. This entitles TVA to perform the necessary surveillance to assure conformance with regulations which provide greater protection for TVA employees and the public. To indicate the interaction between management and health physics within TVA, a copy of a paper presented at the 1969 Health Physics Society Midyear Symposium is included, enclosure 3.

Arms Control and Disarmament Agency - "No."

Civil Service Commission - "None."

U.S. Information Agency -

(Voice of America) - See answer to Question 2.

(Motion Picture and Television Services) - To date no radiation hazards have been identified, consequently no control procedures instituted.

Veterans Administration - VA control procedures pertaining to x-ray, radium, radon and other radiation emitting materials -- In compliance with VA Manual M-2, Part XI, paragraph 2.05 (EXHIBIT 1), all VA personnel habitually in the vicinity of radiation emitting materials or equipment are required to be monitored, through the system of wearing the ionization chambers or film badges. By contractual arrangement, the film badges are evaluated by an outside agency, Tracerlab (EXHIBIT 8). Findings are usually reported directly to the Chief of service. Even a minor overexposure is reported to the Chief of service and to the Director, Radiology Service, VACO, Wash. (EXHIBIT 9). If a repetition of over-exposure is noted for a certain hospital (or a particular person), a thorough review of that department's operation is made.

Post Office Department - 1a. Southern Methodist University, Dallas, Texas is completing the second of two studies under contract for the Bureau of Research and Engineering Human Factors Group. Generally, these studies investigated the problems of sound, illumination, and safety in post offices. These problems have been investigated from the point of view of a university department of management. The findings from these studies which can be verified will be used as partial inputs to projects developing human factors standards, specifications and contract requirements for the procurement of post office systems and equipment. Further projects will be initiated to develop human factors guidelines for post office systems and equipment designers. Progressively, these guidelines will be established for such areas as noise, illumination, vibration, work environment, temperature, humidity, electronic and other types of ionizing radiation.

An interim noise standard for inclusion in contracts for the procurement of postal systems and equipment has been developed and is being circulated within the Bureau of Research and Engineering for review and comment prior to implementation.

b. The following equipment falls under one or more of the radiation categories listed in Attachment 1. Whenever available, a procurement specification for the respective piece of equipment has been included.

## Stamp Tagging Program

In an effort to increase the efficiency of the stamp cancelling operation, a program was undertaken to develop a practical method for treating adhesive postage stamps, stamped envelopes, postal cards, metered impressions and other postal indicia with luminescent materials to provide improved detection.

To date, the program has encompassed the following:

1. A family of luminescent inks, inorganic phosphorescent materials, were developed for overprinting on stamps. This ink material was tested by the Department of Health, Education and Welfare and proved to be neither irritant nor toxic.
2. A bicolor luminescent modification unit was developed for the Mark II Facer-Canceler. This unit activated the luminescent inks to glow by means of ultraviolet rays. "Tagged" first class surface mail stamps glow a greenish color and air mail a reddish-orange color. See Attachment G for POD-L-290C(RC), April 10, 1968: "Luminescent Indicia Detector - Modification Kit for Mark II Facing and Canceling Machines."
3. Nationwide distribution is being made of the following indicia:
    (a) Embossed regular and preferential envelopes
    (b) All postage stamps, first class and air mail, up to 20¢ denomination
    (c) Postal cards
4. Currently undergoing toxicity tests at the Department of Health, Education and Welfare - with results tentatively due in November 1969 - are the following:
    (a) Four types of fluorescent meter inks developed under contracts for the Department by National Cash Register, Frieden, Pitney, Bowes, and Postalia. These inks were expressly developed for use in their respective stamp meter machines. This action was necessary as the Post Office Department does not have control over these postage meter machines. The machines are owned by the respective manufacturers and leased to the users.
    (b) Two types of phosphorescent inks, a blue and a black. These inks were developed by the Government Printing Office for the Department. If tests prove to be non-toxic, the blue ink will be utilized for franked mail (Congressional mail) and the black for penalty type mail (Government Agency mail).
5. Eventually it is anticipated that all Mark II Facer-Cancelers will be converted from an optical recognition to a luminescent recognition system. Currently there are 418 Mark II Facer-Cancelers installed in 161 post offices and the Engineering Test Laboratory. An additional 272 machines are planned for installation prior to April 1970.
6. Phosphormeters were developed and are utilized as standards to measure luminescent color intensity. These instruments are utilized by the Bureau of Engraving and Printing, the Government Printing Office and manufacturers of envelopes with embossed postal indicia to insure conformance with standards.

7. The ultraviolet sensing devices in the modification units on the Mark II Facer-Canceler have shielding and are properly interlocked to preclude exposure to the ultraviolet rays.

## Closed Circuit Television

Closed circuit black and white television systems are utilized to monitor the flow and storage of non-letter size mail within a post office. Television cameras are located at strategic positions along sack/parcel conveyors or transport systems with a television screen located at the control point where an operator can regulate an even flow of mail to the sorting machines.

As of June 1969, there were 47 operational systems in 37 post offices.

Attachment H, POD-C-282D(RE), "Closed Circuit Television Systems," is the most current specification utilized for procurement.

## Ultrasonic Cleaning Equipment

The Post Office Department has four ultrasonic cleaning machines operating in post offices at the present time. Three of these machines utilize an aqueous cleaning technique and these are located in Detroit, Washington, and Boston. Another machine, utilizing Freon as its cleansing agent, is located at the Los Angeles Annex.

Initially all four machines were of the aqueous type and were procured in conformance with Acoustica's Bulletins, No.'s 7801-1 and 7801-2 (Copies of description and specifications for Model 630 Ultrasonic Cleaning Console; See Attachment J), but Acoustica modified one console for the use of Freon.

## Research Projects

Some of the work conducted by the Research Directorate, Bureau of Research and Engineering, encompassing relative degrees of radiation are listed below:

(a) A parcel inspection system is under consideration which will utilize very low-level x-radiation from a radioactive isotope. The level of radiation is predicted to be considerably lower than that of normal, ambient, background radiation; nevertheless, should this system be implemented, monitoring devices will be utilized to insure a safe level of operation.

(b) Also under consideration is a security type alarm system utilizing both radiowave and microwave frequencies. The status of this proposed program will be directly dependent upon the results of a survey of commercially available hardware and post office requirements which is planned for Fiscal Year 1970.

(c) In the research stage is an experimental system to count trayed mail utilizing a low level (1 milliwatt) helium-neon laser. Shields to prevent accidental eye exposure will be developed in conjunction with the program if experimental results prove the feasibility for further development.

(d) A research project is underway to study improved techniques for scanning and displaying address data. If and when the equipment is placed into operation, the operators would be required to view high voltage cathode ray tube displays or equivalent, for long periods of time and at close proximity.

We are aware that there is a possible health hazard in this procedure, and attempts are being made to keep appraised of both potential hazards as well as the means of alleviating same - including the use of low voltage display panels.

## Infrared Heating

A very limited use of infrared heating lamps has been made: e.g.

(a) Small docking areas that are basically outdoors
(b) Over certain pieces of operating machinery

The limited use of this heating media has been due to both the high cost and low efficiency of same.

## X-ray Examination of the Mail

In some cases, foreign mail is examined by x-ray techniques, but in these cases such examination is under the jurisdiction of the Bureau of Customs, Department of Treasury.

## Optical Character Reader

The Philco-Ford Model I Optical Character Reader contains components having ultraviolet, infrared, and x-ray radiations. This radiation is confined to the Mail Transport Unit of which there are two per OCR system. Presently there are ten OCR systems deployed with ten additional OCR systems to be operational in mid-1971 for a total of twenty systems.

No direct measurements have been made to determine the magnitude of the x-ray, ultraviolet, or infrared radiation of the Mail Transport Unit. However, the contractor, Philco-Ford, advises that experience gained in building and testing similar cathode ray tube systems provides a high degree of certainty that no health hazard exists.

In support of their view, the contractor states that the accelerating potential applied to the cathode ray tube is 14,000 volts which is typical of black and white television receivers. Accelerating potentials of less than 20,000 volts are insufficient to produce radiation of sufficient energy to penetrate the glass envelope of the cathode ray tube. By comparison, color television sets use accelerating voltages in the 22,000 to 25,000 volt range.

In the actual mail transport unit, under normal operation of the unit, the cathode ray tube and high voltage power supply are shielded with at least one sixteenth inch (1/16") steel on all sides.

As regards ultraviolet radiation, the mail transport unit operation requires a "lite tight" area for the CRT scanner which prevents any ultraviolet radiation from escaping to the operator area. In addition, the wavelength and intensity of the light emitted from the cathode ray tube present no special hazard. The spectral output of the phosphor of the cathode ray tube peaks at 3800 angstroms and falls to essentially zero at about 3300 angstroms. This is considered to be in the near ultraviolet range and at the power levels present they pose no hazard to the eye or the skin.

During inspection and maintenance periods, when the shield may be removed, any ultraviolet light that could occur (none can occur in operation) is only incident light since a direct view of the cathode ray tube is impossible.

The infrared radiation is produced by an incandescent lamp with an infrared filter. It is also used in a "lite tight" and shielded environment and cannot be viewed directly. In addition, the power output from the light is in the order of one milliwatt.

Spare parts for the optical character reader are under the control of the contractor by virtue of a maintenance contract. There are no surplus cathode ray tubes.

Attachment I; POD-R-377B(RE) dated May 7, 1969, Specification for Manufacture, Installation, etc., of Optical Character Readers Model I, was utilized for the procurement of the ten additional OCR systems scheduled to be operational in mid-1971.

## Post Office Department Maintenance

The Maintenance Division, Bureau of Operations, is responsible for the maintenance of all Post Office Department operated facilities and the operating equipment therein.

In order to accomplish their assigned mission, numerous types of electromechanical devices are utilized in the repair and preventative maintenance programs.

Items which are procured locally are purchased from the usual industrial vendors and the products obtained have the safeguards provided by codes and local standards.

Specialized equipment which is specified by the Bureau of Research and Engineering is usually procured under Post Office Department Specifications - See Answer 1b to Question No. 5, page 15.

Laboratory Equipment

1. Included in the equipment found in the Research and Development Laboratory and Inspection Service Identification Laboratory are the following:

    (a) Low power signal generators - both microwave and radiowave types - as standard equipment.
    (b) Standard low frequency electronic oscillators.
    (c) Standard commercial VHF communication equipment including three "walkie-talkies" and one base station - (Research and Development Laboratory).
    (d) Ultraviolet spectrophotometer.
    (e) Various ultraviolet light devices.
    (f) Infrared spectrophotometer.
    (g) Infrared viewing light.
    (h) Spectrograph.

2. A more systematic approach was able to be undertaken with reference to the Engineering Test Laboratory.

    (a) It is estimated that forty-nine (49) electronic products may emit radiation of various types. They are:

| Attachment 1 Item | Description |
|---|---|
| A.2.1 | Electronic Products, Other: Oscilloscopes (10) |
| B.1.d | Ultraviolet-Other UV Lamps and Welders (7) |
| B.2.a | Visible - white light devices: Bright lights - flash and carbon arc (9) |
| B.2.b | Visible - Other: Arc welder, bright heaters (6) |
| B.3.b | Infrared - dryers, ovens and heaters: Heater (hidden from access) (1) |
| B.4.i | Microwave - TWA's (amplifiers only) (2) |
| B.5.d | Radio and Low Frequency - signal generators; Signal generators, low power (13) |
| B.6.a.7 | Coherent Electromagnetic Radiation - Lasers other Laser - (1) |

(b) Approximately sixteen (16) of the Laboratory's personnel potentially may be exposed to radiation from each type of the foregoing items at varying times.

(c) The general public will not be exposed to any of the above radiation in that access to the Laboratory is controlled.

## Cafeterias - Snack Bars - Vending Machine Locations

In General Services Administration controlled or operated buildings, GSA has under its jurisdiction all cafeterias, blind stands (snack bars under the Randolph-Sheppard Act) and vending machines.

Note: Electronic type ovens are usually found in cafeterias, snack bars, blind stands, and vending machine locations.

In the case of the blind, GSA furnishes space and utilities; the equipment is furnished by the blind.

In the case of cafeterias, the equipment may be furnished by either GSA or the respective concessionaire.

Therefore, in order to obtain any reliable degree of assurance for equipment types and utilization, each post office and postal facility would have to be queried on an individual basis.

## Geiger Counters

Geiger counters furnished by the Office of Civil Defense are controlled against theft rather than specifically for radiation. This is believed to be sufficient for one or two instruments at most locations, considering the weakness of the source.

# APPENDIX 7

## REPLIES TO QUESTION 5

The following is a summary of the replies to Question 5 as provided by the departments and agencies queried. The detailed materials and supporting documents referenced in the replies are on file in the Bureau of Radiological Health.

> QUESTION 5. Does your agency have specifications for the procurement of items, which may emit the types of radiation indicated in Attachment I, which include control of these types of radiation?
>
> If affirmative, please describe briefly the specifications, the types of items to which they apply, and provide a copy of applicable specification documents.

State Department - No. Items are of commercial type - or, if special, are purchased under military specifications.

Treasury Department - (Bureau of Customs) - We do not maintain specifications for the procurement of radiation emitting items. These are developed or obtained at such time as a procurement requirement develops.

(Mint) - Specifications of all equipment bought are standard. Equipment purchased from contractors and manufacturers who meet standards.

Department of the Army - Generally, military specifications are written on items of equipment that are to be purchased by the U.S. Army. The health and safety requirements incorporated in these specifications are reviewed at several different command levels and also by staff personnel in the Surgeon General's Office. However, there are many items of equipment that are considered to be nonstandard. These are off-the-shelf items, that is, purchase is not based on military specifications. Many of these listed in Appendix I are nonstandard. Should these produce electromagnetic radiation, regulations pertaining to their potential hazards will be used.

Navy Department - (BUMED) - The Directorate, Medical Material, Defense Personnel Support Center, has assumed all responsibility for specification writing of standardized medical material and equipment. Inquiries concerning radiation and electronic emission standards should be addressed to that command.

(Electronic Systems Command) - Electronic equipment procured by NAVELEX is being reviewed for safety requirements. The review is based on the type of equipment, installation and application. As a minimum the requirement of safety in MIL-E-16400 is invoked. This employs the MIL-STD-454 requirement 1. Requirement 1 is directed at safety (personnel hazard) and involves use of interlocks, warning markers, grounding rods, etc. An additional requirement is paragraph 7, microwave and X-Radiation in accordance with MIL-R-9673. A complex equipment system specification may require a System Safety Plan as in MIL-S-38130. This requirement provides for safety reviews of design, installation and operation of the system.

(NAVSUP) - NAVSUP does not have any specifications for the procurement of items listed in enclosure (2) of reference (a).

(NAVSHIPS) - Radar and ECM - Not applicable. Signal and Search Lights - No.

Department of the Air Force

A.1 The Air Force, as a matter of policy, is phasing out procurement of products containing radium or radon. The use of accelerator produced radioisotopes in the Air Force is mainly for medical or scientific purposes, as opposed to utilization of generally used items. Only FDA approved radioactive pharmaceuticals are procured.

A.2 Procurement of X-Ray machines is controlled, since standards set forth in applicable NBS handbooks are a minimum requirement, along with industry-wide and accepted safety features. Installation criteria for shielding of these facilities must meet NBS criteria.

Preparation of equipment characteristics is the responsibility of the Defense Medical Material Board. However, a review of Federal Specifications and Military Purchase Descriptions, for stocklisted items of medical equipment, reveals that within the specifications, requirements are included for compliance with the National Fire Protection Association Pamphlet 70, National Electric Code. Requirements also include Underwriters Listing and compliance of Bureau of Standards Handbook 76 for Radiation Protection. Although a survey was not accomplished on all specifications, the sample indicated that safety considerations were specified in most Federal Specifications or Military Purchase Descriptions for items subject to potential hazards.

Procurement of other electronic products is not covered by individual specifications. The units must meet the radiation exposure criteria expressed in previously referenced regulations and standards.

B.1 Control of this type of radiation is not included in procurement specification.

B.2 No procurement specifications exist which deal with the problem of human health and safety. Only user specifications exist to enumerate operational requirements.

B.3 Control of this type of radiation is not specifically included in procurement specifications.

B.4 The USAF uses specification MIL-R-9673C for procurement guidance purposes. When invoked on contracts, it requires radiation levels to be below established standards and requires potential RF hazard areas to be identified. This specification also requires technical data to be prepared in these areas.

B.5 No procurement specifications exist which deal with the problem of human health and safety. Only user specifications exist to enumerate operational requirements.

B.6 The USAF uses specification MIL-R-9673C for procurement guidance of Lasers/Masers. When invoked on contracts, it requires radiation levels to be below established USAF standards and requires potential hazard areas to be identified. Preparation of technical data is also required by this specification.

C.3 Control of this type of radiation is included in procurement specifications, SANE No. 50A, "Cleaner, Filter Element, Ultrasonic", as revised. (See "ACCEPTABLE SOUND PRESSURE LEVELS".)

(C.3) ACCEPTABLE SOUND PRESSURE LEVELS FOR ULTRASONIC CLEANERS*

FREQUENCY RANGE 175 to 5,600 HERTZ

| Octave Band Center Frequency | Octave Band Sound Pressure Level in dB |
|---|---|
| 250 Hertz | 94 dB |
| 500 Hertz | 88 dB |
| 1,000 Hertz | 85 dB |
| 2,000 Hertz | 84 dB |
| 4,000 Hertz | 84 dB |

FREQUENCY RANGE 5,600 to 18 000 HERTZ

| Center Frequency of the One-third Octave Band | One-Third Octave Band Sound Pressure Level in dB |
|---|---|
| 6,300 Hertz | 80 dB |
| 8,000 Hertz | 80 dB |
| 10,000 Hertz | 80 dB |
| 12,500 Hertz | 80 dB |
| 16,000 Hertz | 80 dB |

FREQUENCY RANGE 18,000 to 45,000 HERTZ

| Center Frequency of the One-third Octave Band | One-Third Octave Band Sound Pressure Level in dB |
|---|---|
| 20,000 Hertz | 105 dB |
| 25,000 Hertz | 110 dB |
| 31,500 Hertz | 115 dB |
| 40,000 Hertz | 115 dB |

* All sound pressure levels are expressed in decibels (dB) reference 0.0002 dynes per square centimeter (0.0002 microbar).

These are the maximum acceptable octave band levels, when measured at the head position (cars) of the operator, when at the normal operator's position by the ultrasonic cleaner, and when the cleaner is the source of the sound. The sound pressure level of each octave band shall be at least 10dB lower when measured at any position about the cleaner located a radius length of 15 feet from the position of the center of the operator's head.

Department of Justice -

(Bureau of Prisons) - When we procure x-ray equipment we include the Federal Safety and Health Hazard specifications established by the Veterans Administration in the invitation for bids.

Department of Interior - With the exception of the purchase of a high voltage DC power supply and a portable outdoor voltage divider by the Bonneville Power Authority, there are apparently no specifications designed specifically to control the types of radiation of interest. However, a certain amount of control is possibly achieved through general purchase specifications which require that certain equipment purchased meet the Federal Specifications promulgated by the General Services Administration and recognized safety codes or standards, such as those promulgated by the United States of America Standards Institute.

The specifications used by the Bonneville Power Authority for the purchase of the power supply and voltage divider limited the level of radiation emission to that recommended in the National Bureau of Standards Handbook H93. The solicitations for this equipment are enclosed as Attachment C.

(Bureau of Mines) - No. The research to be performed determines the types of radioactive materials or electronic product items procured. However, projects involving the use of items listed in Sections A1 and A2, Attachment I, must be approved by the Assistant Director---Planning prior to use. See Paragraph 5 B, Enclosure 3.

Department of Agriculture - Products such as x-ray machines and electron microscopes are selected and purchased from commercial firms on a bid basis. The Specifications in the Invitation to Bid include, among other requirements, the types of control devices and features which will insure the safety of operators and personnel around them. These devices and features include timers and controls, radiation shielding around X-ray tube, warning lights and interlocks, etc. See attached Specifications for X-ray Diffraction Unit which are representative of those prepared for these types of products.

Specifications are provided by the requesting scientist and invariably includes requirements for protection of operators.

(Forest Service) - We have specifications for procurement of comparatively low powered radio transmitting and receiving equipment, which is considered non-hazardous; but specifications do not include control of radiation for health hazard purposes.

Department of Commerce -

(NBS) - No.

(ESSA) - Procurement Specifications for Radar Systems Nos. 458.5010 and 458.5512.

(Maritime) - No.

Department of Labor - "No."

Department of Housing and Urban Development - "No."

Department of Transportation - The Federal Aviation Administration is the only operating administration within DOT which indicated that it has specifications for procurement. Refer to enclosed copy of their reply.

Agency for International Development - "No."

Atomic Energy Commission - A determination is made on a case-by-case basis. If a safety control "factor" is found to be needed in a specification for procurement of any of the listed items, then the standard health and safety clause (Note answer 3, page 4.) is inserted in accordance with the provisions of AEC Procurement Regulations, Section 9-7.5006-47.

Civil Aeronautics Board - "N.A."

District of Columbia Government - The D.C. Government has recently initiated requirements that medical and dental x-ray equipment meet Federal specifications as published by General Services Administration. Minimum specifications for other radiation sources have not been established.

Federal Communications Commission - No provision has been made in specifications for the procurement of radiating devices which would limit radiation from such devices insofar as their health hazards are concerned. Except for radio transmitting equipment, the equipment purchased is generally of relatively low rf power generating capabilities. These include, for example, rf signal generators for testing and calibration of other equipment and the oscillator sections of such devices as radio receivers, spectrum analyzers, and frequency standards.

We note that item 2 (e) of the Attachment I mentions klystron tubes. We use klystron tubes in certain of our test equipment and as oscillators in microwave receivers. Since the tubes in these devices generate relatively low power, we have assumed that they do not represent a personnel hazard. If you have contrary information, we would appreciate being advised since in some cases our personnel may be stationed adjacent to the microwave receivers for considerable periods of time.

General Accounting Office - Like most Federal agencies, control over acquisition and eventual disposition of most items is regulated by General Services Administration through their contracts and their Utilization and Disposal Service. For items under GSA Contract, we have just assumed that they exercised appropriate controls and surveillance over any potential health hazard. Also, our physical environment is controlled by GSA through their Public Buildings Service; normal lighting, emergency lighting, cafeteria and snackbar equipment, and similar items all come under the control of General Services Administration.

Interstate Commerce Commission - The Commission has no such specifications. Practically all purchases are made pursuant to GSA specifications and procedures. If GSA has no such specifications, then it would appear that none govern our procurement of such items. However, as reflected in this response, the Commission has seldom, if ever, purchased any devices or items which may emit radiation.

National Aeronautics and Space Administration -

(Ames Research Center) - The Procurement Division aids in the control of the radioactive material by not placing any order for these materials unless the procurement is approved by the Radiation Safety Officer (Enclosure I.) He in turn, establishes who is a qualified user by the use of AEC Form 313, (Enclosure T), personal interviews and concurrence with the Radiation Safety Committee. There are no such controls on the purchase of other equipment of the type in Attachment I of your memo. The Procurement Division informs the Safety Officer when an x-ray machine, x-ray diffraction unit, or laser is purchased, but there is no "sign-off" for this type of procurement.

(Electronics Research Center) - At the present time, this Center does not have specifications for the procurement of items for control of radiation producing equipment.

(Flight Research Center) - Walsh-Healey Act in every contract; safety plan approval before delivery.

(Manned Spacecraft Center) - Procurement of ionizing radiation sources is covered in Part 3.5 of the Radiological Health Manual which is attached. MSC has no procurement specifications for electronic products emitting non-ionizing radiation, which would pertain to control of these radiations.

(Langley Research Center) - Yes, all items which are chemically hazardous or produce hazardous energy must be reviewed and approved by the Chairman of the Subcommittee on Radiation Safety and/or the Safety Office before procurement (Attachment7).

(Lewis Research Center) - Our procurement procedures require that all purchase requests for radioactive material or radiation producing equipment be reviewed by the Health Physics Section prior to purchase. Precautions and action are taken as required.

Before radioactive materials and radiation-producing equipment are procured or used at the Plum Brook Reactor Facility, the program of proposed use is reviewed and approved by the Safeguards Committee and Radiation Safety Committee. Approved procedures of use must be followed, and the user's qualifications and training must be approved by this Committee. Procurement and accountability procedures must be followed.

(Jet Propulsion Laboratory) - All purchase requisitions for purchase of radioactive materials and machines producing ionizing radiation must be approved by the Safety Office before the Procurement Division can place an order for the item. All other types of radiation equipment can be purchased without Safety Office approval.

(Mississippi Test Facility) - The equipment provided both medical services and the laboratory operation were government furnished at the time of facility construction. However, the manufacturer's specifications would be used as purchase specifications.

By contractor (GE): Purchase Specifications for equipment in this laboratory have been based only upon manufacturer's specifications.

By contractor (NAR): The NAR Mississippi operations does not procure locally. California personnel and equipment are utilized and are licensed in both California and Mississippi.

(Marshall Space Flight Center) - (A-1 and A-2) Specifications for the procurement of items which may emit ionizing radiation are contained in Section II of appendix 1. Briefly, these specifications consist of routine purchase requests through the office of the Radiation Protection Officer for review and approval of the Radiological and Isotopes Committee prior to purchase.

(Michoud Assembly Facility) - Boeing: Procurement methods for some items listed in attachment I are found in Boeing Operating Procedure 200.10, "Purchasing of Hazardous Materials - Michoud." However, tubes and various electronic instruments which may produce incidental radiation are not covered in this reference. This procurement method is intended to cover known hazardous equipment and materials.

Chrysler: Chrysler Corporate Procedure No. 112 - "Procurement and Control of Radioactive Materials," a copy of which is attached as CCSD's enclosure D, establishes controls for the procurement of such items.

Mason-Rust: Procurement of items such as X-ray equipment, diathermy unit, and television receiver is governed by specifications established by United States of America Standards Institute.

(Goddard Space Flight Center) - The procurement of new radiation emitting devices is, as specified in the GSFC Radsafe Handbook, (Part III, Tab A) by previously approved workers (custodians) and only after having received the prior approval of the RSO. Should a procurement request not be routed through H&RPO, it will generally be sent to H&RPO by procurement personnel who have been alerted to this responsibility. While, the Radsafe Handbook addressed itself only to ionizing radiation, the Procurement Division is also required to have health and safety approval for RF and laser equipment.

The Procurement Division is also responsible for ensuring that pertinent health and safety clauses, as directed by the NASA procurement directives, are incorporated into GSFC contracts and for ensuring contractor compliance with these requirements. Such health and safety clauses are not included in Part III as they are common throughout NASA and other agencies.

A procurement specification for radionuclide sources, for in-flight use, has been prepared and a study conducted evaluating various sealing techniques according to emission and is included in Part III, Tab W. A part of the specification for radionuclide sources requires the manufacturer to engrave the GSFC-assigned source number on the item. A procurement specification for radiofrequency devices (adopted from MIL-R-9673 B USAF) has been proposed but not yet approved.

General Services Administration - GSA develops, or assigns to other agencies for preparation, Federal Specifications and Federal Standards. Several of these, as listed below, deal with equipment which may emit the types of radiation indicated in PHS Attachment I.

| | |
|---|---|
| W-M-001496 | Monitors, Television, Monochrome (Enc.4) |
| W-T-741 | Tubes, Electron, General Service (Enc.5) |
| GG-T-416 | Timer, Interval; Spring-driven, Photographic (Enc.6) |
| GG-W-113 | Watch, Wrist (Enc.7) |
| GG-X-620 | X-ray Apparatus, Dental (Enc.8) |
| GG-X-625 | X-Ray Apparatus, Radiographic, Mobile, 100 MA (Enc.9) |
| GG-X-630 | X-Ray Apparatus, 15 MA - For Use In Explosive Atmospheres (Enc.10) |
| GG-X-6 | |
| GG-X-632 | X-Ray Apparatus Set, Radiographic, Medical, Head Stand, (Enc. 11) |
| GG-X-635 | X-Ray Apparatus Set, Radiographic and Fluoroscopic, Medical (Enc. 12) |
| Fed Std. No. 222 | Radiation Standard for Communication and other Information - Processing Equipment (Enc. 13) |

The design, as well as the supervision of the construction of GSA projects, including specialized facilities required for laboratories, clinics, etc., may be carried out by in-house resources or by private registered practicing architects or engineers (or A-E firms). GSA criteria are followed in such design and construction supervision. Where such criteria are not available, as might be the case in highly specialized equipment involving hazards from the types of radiation referenced in P.S.S. Attachment I, the designer is required to develop appropriate criteria and to do this in cooperation with GSA and the client agency.

Guide specifications for Radiation Protection Construction (see enclosure 14) and the inspection, including radiographic inspection, of structural steel (see enclosure 15) are attached.

Department of Health, Education, and Welfare -

(Food and Drug Administration) - FDA uses their Radiation Safety Officer for the procurement of radioactive materials.

(National Institutes of Health) - NIH has specifications which are outlined in their Policy and Procedure Memoranda, Procurement No. 4. They do feel that these controls appear to operate quite effectively with respect to X-ray machines and other obvious high voltage equipment, but are least effective in the case of small ultraviolet sources and ultrasonic equipment.

(Health Services and Mental Health Administration) - HSMHA uses the Federal and VA specifications for procurement.

(Social Socurity Administration) - The Central Office of the Employee Health Service initiates procurement requisitions for radiation producing equipment.

(Environmental Control Administration, Bureau of Radiological Health) - Procurement of X-ray apparatus is under GSA Federal Specification GG-X-635d which has a requirement under Section 3.1.1.2 Radiation Protection "The apparatus offered shall be in accordance with the requirements of NCRP Report No. 33. Any applicable sentence regarding X-ray apparatus using the words 'shall,' 'should', or 'advisable' shall be considered a requirement."

Procurement of other items listed in attachment II does not routinely include control of radiation.

Government Printing Office - The Government Printing Office does generate specifications for the procurement of any item included in Attachment I. However, we do not include standards on the control of radiation from these devices for the reasons outlined under item 2.

Smithsonian Institution - Specifications for the procurement, and/or disposal of electronic products can be drawn up ultimately, as needed.

Tennessee Valley Authority - All specifications written for the purpose of obtaining sources or equipment which produce ionizing radiation are reviewed by health physics staff prior to being released for bid invitation.

Civil Service Commission - Procurement for the Civil Service Commission is made pursuant to the regulations of the General Services Administration. In procuring physical equipment, we use their schedules or specifications, or would work with them in developing the necessary specifications, if none existed.

U.S. Information Agency -

(Voice of America) - The VOA procures transmitters which must meet rigid FCC and international specifications regarding spurious and harmonic radiations. Under normal operational procedures, our transmitters are better than 60 db down below the fundamental on spurious and harmonic emission and any radiation of such low levels would be negligible as regards biological effects. Each transmitter is shielded and properly grounded to minimize the r.f. radiation within the transmitter building.

(Motion Picture and Television Service) - We have no specifications relative to radiation control for equipment.

Veterans Administration - Attached is a series of specifications (EXHIBIT 10) currently used by VA and other government agencies to purchase some of the items indicated in ATTACHMENT I. The variation of types, and degree of their scope, indicates the difficulty our marketing personnel face in procuring these items. Due to constant introduction of new items and frequent redesigning of existing equipment, it is almost impossible to maintain a current series of specifications, especially on items which are less active. Of all the specifications attached, the Fed. Spec. GG-X-635d (EXHIBIT 6) is probably the most current and most thorough. It was originally developed and is being kept current by VA and is used to purchase 90% of our x-ray diagnostic equipment. GG-X-635d was developed to comply with the radiation safety requirements stipulated in National Bureau of Standards Handbook 76 (EXHIBIT 4) and National Council on Radiation Protection and Measurements Report No. 33 (EXHIBIT 5). The VA specification X-1217a dated November 18, 1964 (EXHIBIT 11) for purchase of cobalt 60 units is being up-dated and revised. It is included to illustrate a different type of specification (one that is less elaborate than the GG-X-635d and which covers only the most essential characteristics of a particular unit). Numerous one-source items such as deep x-ray therapy units, isotope scanners,etc. are negotiated items. Normally these items are purchased without specifications, or solely through professional request for a specific manufacturer's model number. Equipment purchased against specifications is inspected for compliance by VA Depot equipment specialists and by hospital physicists (EXHIBIT 7).

Post Office Department - No. The Post Office Department, when procuring items which emit the types of radiation indicated in Attachment 1, uses the Federal Specifications which include control of these types of radiation.

In the case of the Post Office Department equipment procured under POD Specifications, the specification has been prepared - to the best of knowledge - to preclude the procurement of equipment having a known hazard.

## APPENDIX 8

## REPLIES TO QUESTION 6

The following is a summary of the replies to Question 6 as provided by the departments and agencies queried. The detailed materials and supporting documents referenced in the replies are on file in the Bureau of Radiological Health.

> Question 6. Does your agency have any regulations, standards, directives, specifications, or other methods pertaining to control of the disposition of used or surplus items which may emit the types of radiation indicated in Attachment I?
>
> If affirmative, please describe briefly such documents or control methods and provide a copy of applicable documents.

State Department - No. Regulations as prescribed by the General Services Administration for the disposal of surplus government property are followed.

Tresury Department - (Mint) - No surplus material disposed to date.

(Bureau of Customs) - This agency does not have any regulations, etc., pertaining to the disposition of used or surplus radiation emitting devices.

Department of the Army - Published regulations control the disposition of items of equipment which contain radioactive material (AR 755-15, "Disposal of Unwanted Radioactive Material"). Surplus or salvage equipment is normally disposed of through the routine Army supply system. There are no established safety standards for disposal of equipment which do not contain radioactive materials. Routine disposal of this equipment is by normal procedure.

Navy Department -
(BUMED) - Regulations concerning the disposal of medically oriented equipment are also under the Department of Defense and as such are contained in the Defense Disposal Manual.

(NAVSUP) - NAVSUP has issued enclosures (1) and (2), and NAVSUP field activities have issued instructions such as enclosures (3) and (4) on the control of the disposition of used or surplus items which contain radioactive material.
(1) NAVSUP Instruction 4510.27
(2) BUSANDA Instruction 5100.10
(3) NSC Pearl Harbor Instruction 5100.4C
(4) NSC Pearl Harbor Instruction 6150.1A

(NAVSHIPS) -

| | |
|---|---|
| a. NAVSHIPS 0389-015-3000<br>NAVSHIPS 0389-026-6000<br>NAVSHIPS 0389-028-8000 | Disposal of radioactive liquid effluents from naval nuclear-powered ships, their tenders and supporting shipyards. |
| b. NAVSHIPS 0967-000-0050 | Hazards of Radioactive Luminescent Material (1-2-a). Radioactive Waste Disposal (1-2-g.h.k. and j.). |
| c. NAVSHIPSINST 9890.20<br>4 August 1966 | Radioactive Liquid Waste Disposal System on Radiological Repairs Barges. |
| d. NAVSHIPS 0967-000-0100<br>General Handbook | Disposal of broken tubes (containing radioactive material) and waste and decontamination of surfaces. |
| e. NAVSHIPS Tech. Manual<br>NAVSHIPS 0901-670-0002 | Disposal of items containing radioactive material. |
| f. BUSHIPSINST 5100.16 of<br>24 April 1963 | Control of contamination from radioactive luminescent materials (including decontamination). |
| g. NAVSHIPS 0967-001-3672 | Safety - Radioactive Electron-Tube Hazards. |
| h. NAVSHIPS 0967-000-0130<br>Par 1-15i(4) | Decontamination, use of sealed containers, where to dispose cans. |

Department of Air Force - Insofar as can be determined, with the exception of radioactive material, no special instructions exist within the Air Force concerning the resale or donation of products discussed within the context of this report. In some cases, excess equipment is rendered unusable when deemed to be appropriate in the interest of public health and safety, but distinction as to specific items requiring such action is not made.

A.1 The disposal of radioactive wastes is covered by T.O. 00-11 ON-2. Resale of surplue items containing radioactivity is closely controlled, as per AFM 67-1, Chapter 3, VOL VI.

A.2 We are not aware of any regulations, directives, etc., controlling disposition of X-Ray machines based solely on the fact that they can produce ionizing radiation.

The disposition of used and/or surplus items of these types (2b through 2h) is covered by AFM 67-1. They are handled as standard electronic products.

B.1, B.3, C.3 The disposition of used and/or surplus items is covered in Volume VI of AFM 67-1.

B.2 Special instructions do not exist for items discussed in this section concerning the resale or donation of excess Air Force property.

B.4, B.6 We are not aware of any regulations, directives, or policy guidance documents which control disposition of microwave or laser/maser equipment, based solely on the fact that they can produce non-ionizing radiation in this portion of the electromagnetic spectrum. Disposition of used and/or surplus microwave generators or laser/maser equipment is in accordance with AFM 67-1. In some cases, excess equipment is rendered unusable when deemed appropriate in the interest of public health and safety, but distinction as to specific items requiring this action is not made.

B.5 Special instructions do not exist for items discussed in this section concerning the resale or donation of excess Air Force property.

C.1, C.2 Special instructions do not exist for items discussed in this section concerning the resale or donation of excess Air Force property.

Department of Justice - While the answer is generally negative the Bureau of Marcotics and Dangerous Drugs indicates a disposition of used radioactive materials to be performed by returning the materials to the manufacturer.

Department of Interior - No special regulations - the general policies and guidelines of the General Services Administration are adhered to.

(Bureau of Mines) - Bureau regulations require records be maintained of procurement, transfer, storage, and disposal of all radioactive materials and ionizing radiation-producing media, such as listed in Sections A1 and A2, Attachment I. See paragraphs .5C(6), .7A(6), and .7A(8)(a), Enclosure 3, and Sections 3 (a), (b), and (c), Enclosure 12, Radiation Report.

Department of Agriculture - The Department has a procedure for advertising surplus items within the Department so that an interested party can obtain them. In the case of items listed in Section A of Attachment I, RSC approval must be obtained before the items are acequired. Control procedures are the same as previously described for radiation emenating equipment. Attached form AD-109 is used for surplus property.

The Radiological Safety Officer maintains records of the disposal of radioactive material. Moreover, the Radiological Safety Committee is required to give approval prior to the transfer, exchange, or other disposition of radioactive material and/or radiation-emanating equipment.

(Forest Service) - Disposition of radioactive materials is covered in Forest Service Manual.

Department of Commerce -
(NBS) - No.

(ESSA) - No.

(Maritime) - No.

U.S. Information Agency - As a general rule, this Agency does not dispose of transmitters on the surplus market. Transmitters which become inoperative or obsolete are used for spare parts and not released as operating transmitters.

Federal Communications Commission - The Commission has no specifications or control measures pertaining to disposition of surplus items which may emit radiation, except that transmitters it disposes of are generally made inoperable to avoid unauthorized use by others.

Department of Housing and Urban Development - "No."

Department of Transportation - The Federal Aviation Administration is the only operating administration within DOT which indicated that it has promulgated directives pertaining to control of the disposition of the subject items. Refer to the enclosed copy of their reply.

Agency for International Development - This Agency does utilize excess Government property in the Foreign Assistance Program. Only an extremely small amount of this equipment comes under the scope of the attachment 1 listing. No regulations, standards, directives, or specifications are in effect pertaining to the control of the disposition or the functioning of this equipment.

Atomic Energy Commission - Yes. With respect to A-1 and 2 of Attachment I, the AEC has implemented Manual Chapters 5170 and 5182, which authorize the disposal of contaminated property without restrictions provided that contamination is below prescribed levels. Recently, the AEC has revised its property management instructions and incorporated the MC-5170 and 5182, as modified, into "Part 109-45 Sale, Abandonment or Destruction of Personal Property." The Part 109 requirement prescribes policies and methods governing the transfer, sale, abandonment, or destruction of excess or surplus property (including salvage, scrap, and waste materials) which have small amounts of radioactive contamination, where such contamination can generally be reduced to low, radiologically safe levels, but where complete removal of contamination may not be feasible because of economic or technological factors. Part 109 is currently going through final concurrence procedure. Final approval and publication is anticipated within 90 days and a copy will be transmitted to you at that time.

Generally, the Federal Property Management Regulation Sub-Part 101-45.3 "Sale of Personal Property," applies to all three categories in Attachment I. The disposition of used or surplus items referred to in Section 101.45.309.3, "Dangerous Property," is governed by the following rule:

> "No property shall be disposed of that is dangerous to public health and safety without rendering innocuous such property or providing adequate safeguards therefore."

Civil Aeronautics Board - "N.A."

District of Columbia Government - To encourage users to dispose of grossly substandard and hazardous X-ray equipment, rather than attempt to sell it to unsuspecting buyers, the Department of Public Health offers free disposal service. Attached is a letter illustrating the type of statement signed by the owner when such equipment is removed. Unused or unwanted radium may also be disposed of through the Department of Public Health.

General Accounting Office - "No - through GSA."

Interstate Commerce Commission - "None."

National Aeronautics and Space Administration -
(Ames Research Center) - Disposal of radioactive material is monitored by the use of Enclosures E, F, G, J, and K. The Safety Office audits the incoming activity against the disposed material, thereby keeping a continuously current inventory.

(Manned Spacecraft Center) - Disposition of used or surplus items which contain or emit ionizing radiation is covered in Part 3.5 and 3.13 of the Radiological Health Manual. MSC has no regulations, standards, directives, specifications, or other methods pertaining to the control of the disposition of used or surplus items which emit non-ionizing radiation.

(Electronics Research Center) - ERC does not have any regulations, standards, directives, specifications, or other methods to control the disposition of used or surplus radiation emitting devices.

(Flight Research Center) - "Inspection of Scrap Metal" (NASA/FRC document), applicable Air Force Technical Orders and Regulations, NBS Handbooks, AEC Act of 1954 plus amendments.

(Langley Research Center) - Langley Research Center regulations apply to used, surplus, and new material and equipment. AEC, DOT, and other regulations are followed where applicable.

(Lewis Research Center) - Disposal of radioactive material is made considering appropriate regulations (AEC, DOT). Disposal is accomplished through the Health Physics group via a commercial waste disposal contractor. Control of the disposition of used or surplus items is under the Plum Book Station Procurement Office. All radioactive materials subject to AEC regulations are transferred to licensed persons only.

(Jet Propulsion Laboratory) - The disposal procedure is called out in the JPL Radiation Safety Manual for radioactive materials and the disposal is handled by the Safety Office. This is the only type of item that has this control.

(Mississippi Test Facility) - Not applicable to medical services or the lab function at this time. Not applicable to contractors.

(Marshall Test Flight Center) - (A-1) Regulations pertaining to control of the disposition of used or surplus items of radioactive material are contained in Section VII of appendix 1.

(Michoud Assembly Facility) - Boeing: Boeing Industrial Hazards Control Bulletin Manual, Industrial Hazards Control Bulletin #77, "Pollution Control - Disposal of Packaged Radioactive Wastes at Sea," covers disposal techniques for electronic equipment and the like. No radioactive material has been disposed of at sea from this location.

Chrysler: The disposal of used or surplus items is also covered by the procedure cited in subparagraph 4d(2) above.

Mason-Rust: Any disposition would be through established government disposal channels.

(Goddard Space Flight Center) - The H&RPO is the only GSFC authorized agent for the disposal or extended storage of radionuclide sources. Ultimate disposition is carried out in accordance with standards cited in the attached bibliography and Radsafe Handbook. There are no regulations requiring the disposition of electronic devices through the H&RPO. However, past performances show that the Property Officer and his personnel check with the H&RPO prior to making any change in the disposition of equipment which they believe to involve, in any manner, the emission of radiation.

Peace Corps - "No."

General Services Administration - Requirements concerning the utilization, sale, abandonment, and destruction of personal property are contained in subchapter H of the Federal Property Management Regulations issued by the General Services Administration. Specific requirements concerning personal property dangerous to public health and safety are attached. (See enclosure 16 concerning utilization of excess personal property, enclosure 17 concerning the sale of personal property, and enclosure 18 concerning the abandonment or destruction of surplus property.)

Tennessee Valley Authority - No, unless such items contain radioactive sealed sources. Disposal methods and standards as described in 10 CFR 20 are followed if radioactive material is involved.

Civil Service Commission - Items of equipment excess to the needs of the Civil Service Commission are disposed of in accordance with the regulations of the General Services Administration. Items of equipment being replaced because of age or obsolescence are generally traded in.

Veterans Administration - The VA surplus property is subject to control and disposition of Federal Property Management Regulations (RPMR) as published and distributed by GSA. All VA surplus property is reported to GSA and disposed of, or transferred to, according to their directives.

Post Office Department - No other than those contained in Attachment F (Part 124 Nonmailable Matter from the Postal Manual containing pertinent instructions and a chapter on radioactive matter) for Answer No. 1. Also, any surplus geiger counters mentioned on page 18 under question number 7 would be returned to the Office of Civil Defense or to the State civil defense office for disposition.

Government Printing Office - "No."

Department of Health, Education, and Welfare -
(Bureau of Solid Wastes Management) - If the need should arise, would have their safety officer request assistance from the BRH.

(Bureau of Radiological Health) - Radioactive waste is disposed or under agreement with the Department of the Army. Other items are not controlled as to disposition.

(National Institutes of Health) - Disposals involve the use of a property transfer report which specifically requires clearance with respect to radioactivity contamination.

(Health Services and Mental Health Administration) - Informs the BRH, which retains a registry of their equipment, whenever modifications in structure or equipment occur. This includes a description of the old equipment, condition, and where the equipment will be sent.

(Food and Drug Administration) - The procurement and disposal of all radioactive materials are carried out through the Radiological Safety Officer (RSO). Radioactive waste is disposed of (a) by incineration within limits set forth in 10-CFR-20 or (b) by packaging in AEC-approved barrels and shipping through a contractor to an AEC-approved burial ground.

BLANK PAGE

## APPENDIX 9

## REPLIES TO QUESTION 7

The following is a summary of the replies to Question 7 as provided by the departments and agencies queried. The detailed materials and supporting documents referenced in the replies are on file in the Bureau of Radiological Health.

QUESTION 7. Does your agency or your contractors use or possess any electronic product or radioactive material which may emit the types of radiation indicated in Attachment 1?

If affirmative, please provide the following:

(a) An estimate of the number of each type of electronic product or radioactive source.
(b) An estimate of the number of agency or contractor personnel who potentially may be exposed to radiation from each type of electronic product or radioactive source.
(c) An indication of whether or not members of the general public, i.e., persons not under the control of your agency or contractor, potentially may be exposed to radiation from each type of electronic product or radioactive source.

A summary of the estimates of the numbers of electronic product radiation sources and certain radioactive materials reported by the Federal departments and agencies is shown in Table 2.

Department of State - The following estimates of radiation-producing units and personnel who potentially could be exposed to radiation covers both our domestic and Foreign Service operations:

| Radiation Source | Personnel Potentially Exposed |
|---|---|
| 2 X-ray machines (medical) | 5 technicians and radiologists |
| 40 X-ray machines (special) | 75 technicians |
| 4 klystron tubes | 14 technicians |
| 150 RF transmitters (100 watt) | 200 employees |
| 5 ultrasonic cleaners | 100 employees |
| 11 therapeutic lamps | as directed by medical personnel |
| 14 microwave ovens | 100 food service personnel at GSI (operated in State Department Building) |
| 30 photocopy machines | certified non-radiation producing |
| 16 T.V. sets (government owned) | no estimate |

With the exception of the T.V. sets, the general public is not exposed as radiation sources are in restricted or operational areas.

| | A.1 | A.2 | B.1 | B.2 | B.3 | B.4 | B.5 | B.6.A | B.6.B | C.1 | C.2 | C.3 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Radium, Other Natural Sources & Accelerator Produced Radionuclides | Ionizing Radiation Producing Devices | Ultraviolet | Visible | Infrared | Microwave | Radio & Low Frequency | Lasers | Masers | Infrasonic | Sonic | Ultrasonic | Total A.2-C.3 |
| State | - | 62 | 11 | - | - | 14 | 150 | - | - | - | - | 5 | 242 |
| Treasury | - | 12 | 21 | - | 11 | - | - | 2 | - | - | - | 5 | 51 |
| Army | * | 4,119 | 169 | 4,500 | 5,500 | 19,145 | 6,060 | 630 | 3 | ? | ? | 767 | 40,893 |
| Navy | 340 | 5,994 | 204 | 9,575 | 9,365 | 4,174 | 1,005 | 328 | 495 | - | 600 | 164 | >31,904 |
| Air Force | x+ | 35,509 | 1,443 | 1,043 | 30 | 3,466 | 28,879 | 210 | - | x | > 1,000 | 1,058 | >72,638 |
| Justice | - | >303 | 48 | - | 72 | 27 | 360 | - | - | - | x | 33 | >843 |
| Post Office | x | x | >7 | >15 | > 1 | x | > 13 | 1 | - | - | - | 4 | > 41 |
| Interior | 59 | 939 | 243 | 475 | 259 | 240 | 1,520 | 59 | - | 1 | 7 | 96 | 3,839 |
| Agriculture | 170 | 48 | x | x | x | x | x | x | - | - | - | x | >48 |
| Commerce | 222 | 471 | 181 | 74 | 159 | 287 | 346 | 84 | 3 | 9 | 83 | 86 | 1,783 |
| Labor | | | | | | | None | | | | | | |
| HUD | | | | | | | None | | | | | | |
| Transportation | x | > 3,953 | 4 | - | 183 | >1,527 | >11,550 | - | - | 5 | 1 | 36 | >17,259 |
| HEW | 3,356 | 1,702 | 3,722 | 1,161 | >1,132 | 141 | 416 | 35 | - | 2 | >176 | 286 | > 8,773 |
| AEC | | 210 | | | | | Compiling Inventory | | | | | | >210 |
| AID | | | | | | | No Way To Estimate | | | | | | |
| CAB | | 1 | | | | | | | | | | | 1 |
| D.C. Government | | 115 | | | | | | | | | | | >115 |
| FCC | - | 120 | - | - | - | 13 | 244 | - | - | 1 | x | 1 | > 379 |
| GAO | | 1 | | 1 | | | | | | | 4 | | 6 |
| ICC | - | 3 | - | - | 2 | - | x | - | - | - | - | - | 5 |
| Library of Congress | | | | | | | None | | | | | | |
| NASA | >271 | >1,195 | 549 | >275 | >1,110 | >637 | >2,068 | 366 | 4 | 56 | 24 | >145 | >6,429 |
| Peace Corps | - | 6 | | | | | | | | | | | 6 |
| GSA | | 2,705 | 8 | | x | x | x | | | | | 17 | >2.730 |
| GPO | 120 | 12 | 70 | 40 | 500 | - | - | - | - | - | 250 | - | 872 |
| Smithsonian | 4 | 27 | 19 | 17 | 15 | 20 | 11 | 3 | 1 | | 1 | 7 | 121 |
| TVA | 77 | 217 | 12 | - | 41 | 9 | 40 | - | - | 7 | 2 | 14 | 342 |
| Selective Service | | | | | | None | | | | | | | |
| Arms Control | | 2 | | | | | | | | | | | 2 |
| Civil Service | | 4 | | | | | | | | | | | 4 |
| USIA | - | 86 | - | 7 | - | - | 102 | - | - | - | - | 1 | 196 |
| VA | 990 | 11,049' | 1,539 | 199 | 1,207 | 320 | 654 | 21 | - | - | - | 587 | 15,576 |
| TOTAL | >5,607* | >68,865 | >8,250 | >17,382 | >19,587 | >30,020 | >53,068 | >1,739 | 506 | >81 | >2,118 | >3,312 | >204,958 |

x - In use - No estimate of number.

* - Several hundred thousand sources including several hundred grams of radium and several hundred curies of accelerator-produced radionuclides.

' - Includes 7,776 B&W TV.

+ - 0.1 Ci Radium
0.16 Ci Cobalt 57
0.0003 Ci Sodium 22
0.025 Ci Polonium 208-209

Table 2. Summary of Use, by Federal Agencies, of Radiation Producing Electronic Products and Other Radiation Sources with Distribution According to Type of Radiation Produced.

Treasury Department - (a) A list is provided of 51 items of radiation producing equipment used by the Treasury Department.

| Radiation & Equipment | Mint | E&P | Customs | TUS | Total |
|---|---|---|---|---|---|
| A. (2) Electronic products | | | | | |
| a. X-ray machines | 4 | | 6 | | 10 |
| f. electro microscopes | 1 | | 1 | | 2 |
| B. (1) Ultra violet | | | | | |
| d. lamps & spectro scopes | | 12 | 8 | 1 | 21 |
| (3) Infra red | | | | | |
| b. driers | | 6 | | | 6 |
| c. medical | | 3 | | | 3 |
| d. viewers | | | | 2 | 2 |
| (6) Electro magnetic | | | | | |
| a. Lasers | | | | | |
| 1. experimental | | | 1 | | 1 |
| 7. microprobe | | 1 | | | 1 |
| C. (3) Ultra sonic | | | | | |
| c. cleaning baths | 1 | 4 | | | 5 |
| | | | | TOTAL | 51 |

(Bureau of Customs) - (b) Most of this equipment is used in the nine Customs laboratories located throughout the United States. A total of 120 employees have some limited exposure to these items in their laboratories.

(c) Exposure to the public is extremely limited and when it does occur it is only for a matter of seconds.

(Mint) - Four X-ray fluorescence units.

(b) Three persons in each of San Francisco, Denver and Philadelphia units. Five persons in Washington, D.C.

(c) No members of public subject to exposure.

(Engraving and Printing) - (c) The public is not exposed to any radiation from any equipment in the Bureau.

Department of the Army - The estimate of items of equipment that was requested is furnished. The information upon which this estimate is based was received from the U.S. Army Environmental Hygiene Agency, Electromagnetic Compatibility Analysis Center and the National Inventory Control Points. The personnel assigned to USAEHA perform surveys on all military installations in the United States. These services are also provided outside the United States upon request from the overseas commander.

The request for the number of agencies or contractor personnel who may be potentially exposed to the various types of radiation would be several hundred thousand. However, only about 70 people per year are reported to receive excessive exposures to ionizing radiation. These are very minor occupational exposures. There is no information available that would indicate that any other personnel are receiving other types of radiation exposure. However, surveys conducted by USAEHA personnel at many of these installations have indicated that there are no areas where the general public or working personnel are being exposed to potential microwave hazards.

Ionizing electromagnetic and particulate radiation from the following:

1. Radioactive materials other than materials regulated under the Atomic Energy Act of 1954, such as:

| | |
|---|---|
| (a) Radium | |
| (1) Medical use | approx. 1500 milligrams |
| (2) Industrial use (for Army) | several hundred grams |
| (3) R&D | several hundred grams |
| (4) Supply items | several hundred thousand |

(i.e., static eliminators, smoke detectors, compasses, watches, speedometer dials and numerous other types of dials containing radioactive luminous compound.)

| | |
|---|---|
| (b) Radon and daughters | |
| (1) Medical use | approx. 1 curie |
| (2) R&D | approx. 1 curie |
| (c) "Natural" radionuclides | unknown |
| (d) Accelerator-produced radionuclides (i.e., Cobalt-57, Sodium-22) | |
| (1) Medical use | approx. 300 millicuries |
| (2) Industrial (DA Authorization primary rockets) | several hundred curies |
| (3) R&D various hardware research (Cobalt-57) | several hundred curies |

2. Electronic products, such as:

| | |
|---|---|
| (a) X-ray machines | 1735 total |
| (1) Medical | 940 |
| (2) Dental | 460 |
| (3) Therapeutic | 25 |
| (4) Industrial | 310 |
| (b) Television receivers (teaching aids, officers' club, NCO clubs, dayrooms, hospitals) | approx. 2,000 |
| (c) Neutron generators | 6 |
| (d) Accelerators | 15 |
| (e) Klystron tubes | 232 operating tubes |
| (f) Electron microscopes | 30 |

| | |
|---|---|
| (g) X-ray diffraction instruments | 50 |
| (h) Electron beam welders | 5 |
| (i) Spectro photo | 16 |
| (j) Gas chromatographs | 30 |

Nonionizing electromagnetic radiation, such as the following:

| | |
|---|---|
| 1. Ultraviolet - from: | |
| (a) biochemical and medical analyzers | 20 |
| (b) cosmetic and therapeutic lamps | 94 |
| (c) sanitizing and sterilizing devices | 55 |
| 2. Visible, from: | |
| (a) white light devices (search light) | approx. 4,500 |
| (b) welding flames & numerous lighting devices | unknown |
| 3. Infrared, from: | |
| (a) alarm systems | unknown |
| (b) dryers, ovens and heaters | unknown |
| (c) others | |
| (1) search lights | approx. 3,000 |
| (2) acetylene welder's torch | approx. 1,500 |
| (3) arc welders | approx. 1,000 |
| 4. Microwave, from: | |
| (a) alarm systems | 1 |
| (b) diathermy units | 1 per major hospital, CONUS |
| (c) dryers, ovens, heaters | 1,200 |
| (d) medico-biological heaters | 8 |
| (e) microwave power generators | 470 above 400 MHz<br>12,739 below 400 MHz |
| (f) radar devices | 1,696 |
| (g) remote control devices | unknown |
| (h) signal generators | in the broad term used there are several thousand |
| 5. Radio and low frequency, from: | |
| (a) cauterizers | unknown |
| (b) diathermy units | 60 |
| (c) power generator & transmission equipment | several thousands |
| (d) signal generators | several thousands |
| 6. Coherent electromagnetic radiation produced by stimulated emission, from: | |
| (a) Lasers | |
| (1) cauterizing, burning & welding | 5 |
| (2) cutting & drilling devices | 5 |
| (3) communications transmitters | 20 |
| (4) range finding devices | 100 |
| (5) laboratories, R&D, etc. | 500 |

| | |
|---|---|
| (b) Masers | |
| (1) communication transmitters | 2 |
| (2) others | 1 |

Infrasonic, sonic, and ultrasonic vibrations, resulting from operation of an electronic circuit, such as:

| | |
|---|---|
| 1. Infrasonic, from: | |
| (a) vibrators | unknown |
| (b) other | unknown |
| 2. Sonic, from: | |
| (a) electronic oscillators | unknown |
| (b) other | unknown |
| 3. Ultrasonic, from: | |
| (a) cauterizers | unknown |
| (b) cell & tissue disintegrators | 5 - R&D Labs. |
| (c) cleaners | 750 |
| (d) diagnostic & nondestructive testing equipment | 12 test equipment |
| (e) ranging & detection equipment | unknown |

Department of the Navy - (Bureau of Medicine and Surgery) - The BUMED uses the following:

(A.1)(a) 15-20 radium sources
(A.2)(a) 2300-2500 X-ray machines
(b) 1500 television receivers
(c) 2 neutron generators
(f) 5 electron microscopes
(B.4)(b) 100 diathermy machines (microwave)
(c) 75 ovens
(d) 50 medico-biological heaters

All active duty Navy/Marine Corps, retired personnel and their dependents are considered as the potential population who may be exposed to diagnostic and therapeutic types of radiation and electronic equipment. Moreover, many civilian and contract personnel who are employed by the government are also part of the potential population on a lesser scale.

In certain isolated instances such as emergency medical care and/or other "visitors" may be exposed to some types of radiation or electronic equipment exposure. The overall exposure hazard would closely parallel the general conditions of the civilian community.

(Naval Supply Systems Command) - NAVSUP activities, including contractors, both use and possess electronic products and radioactive material which may emit types of radiation listed in enclosure (2) of reference (a). No members of the general public are exposed to potential radiation hazards. It is estimated that the below stated numbers of NAVSUP personnel are occupationally exposed to potential radiation hazards:

(1) Radium - 20 personnel
(2) X-ray - 40 personnel
(3) Ultraviolet, "white" light, and infrared - 50 personnel
(4) Microwave - 30 personnel
(5) Radio and Low frequency - 15 personnel
(6) Sound vibrations - 30 personnel

(Naval Ship Systems Command) - NAVSHIPS uses approximately 10,000 radar units, and 5000 ECM units. The number of RF communications transmitters, white light sources, lasers, power generation and transmission equipment, and radar high voltage tubes in use is unknown. However, due to Navy use being primarily at sea, any numbers of exposed persons would necessarily be limited.

(Naval Facilities Engineering Command) - NAVFAC uses the electronic products shown in the following table:

| Type | Estimated No. | Estimated No. of Contractor or Agency Personnel Exposed | Potential of General Public Exposure |
|---|---|---|---|
| Industrial X-ray | 6 | 30 | None |
| Medical X-ray | 3 | 150 | None |
| Electron Beam Welders | 6 | 24 | None |
| Oscilliscope, Cathode Ray Tubes | 10 | 100 | None |
| White Light Devices (Fluorescent Tubes) | 5,000 | 200 | Visitors only |
| Sonic, Electronic Oscillators | 100 | 15 | None |
| Ultrasonic Cleaners | 6 | 12 | None |
| Radiac Simulators (Radio Controlled) | 15 | 54 | None |

(Naval Ordnance Systems Command) - The following lists the electromagnetic radiation equipment under the cognizance of NAVORD:

(A) Equipments capable of emitting ionizing electromagnetic radiation:
    56 X-ray machines
    80 B/W TV receivers
    1221 Klystron tubes
    3 Electron beam welders
(B) Equipments capable of emitting non-ionizing electromagnetic radiation:
    1040 Radar units
    10 RF signal generators
    65 Radio transmitters

(Naval Material Command - R&D Laboratories) - Inventory is as follows:

| Types of Radiation | (a) No. of products or radioactive sources on hand | (b) No. of agency/ contr. personnel potentially exposed | (c) Potential exposure of general public* |
|---|---|---|---|
| A. Ionizing electromagnetic & particulate radiation from the following: | | | |
| 1. Radioactive materials other than materials regulated under the Atomic Energy Act of 1954 such as: | | | |
| (a) radium | 180 | 40 | X |
| (c) other "natural" radionuclides | 63 | 50 | X |
| (d) accelerator produced radionuclides | 77 | 45 | Y |
| 2. Electronic products such as: | | | |
| (a) X-ray machines | 390 | 485 | X |
| (b) television receivers | 500 | 1150 | X |
| (c) neutron generators | 25 | 100 | X |
| (d) accelerators | 22 | 110 | X |
| (e) klystron tubes | 75 | 200 | X |
| (f) electron microscopes | 13 | 50 | X |
| (g) X-ray diffraction instruments | 12 | 25 | X |
| (h) electron beam welders | 1 | 6 | X |
| (i) other | 60 | 145 | X |
| B. Non-ionizing electromagnetic radiation: | | | |
| 1. Ultraviolet from: | | | |
| (a) biochemical & medical analyzers | 7 | 15 | X |
| (b) cosmetic & therapeutic lamps | 15 | 60 | X |
| (c) sanitizing & sterilizing devices | 40 | 100 | X |
| (d) welding devices | 12 | 48 | X |
| (e) other | 130 | 200 | Y |

---

*X - extremely remote; Y - unlikely; Z - possible.

| | (a) | (b) | (c) |
|---|---|---|---|
| Types of Radiation | No. of products or radioactive sources on hand | No. of agency/ contr. personnel potentially exposed | Potential exposure of general public* |
| 2. Visible, from: | | | |
| (a) white light devices | 4075 | 8000 | X |
| (b) other | 500 | 770 | Z |
| 3. Infrared, from: | | | |
| (a) alarm systems | 65 | [illegible] | X |
| (b) dryers, ovens, & heaters | 300 | 1500 | X |
| (c) other | 9000 | 1500 | X |
| 4. Microwave, from: | | | |
| (a) alarm systems | 65 | 160 | X |
| (b) diathermy units | 12 | 30 | X |
| (c) dryers, ovens, heaters | 110 | 850 | X |
| (d) medico-biological heaters | 5 | 10 | X |
| (e) microwave power generating devices | 600 | 750 | X |
| (f) radar devices | 400 | 825 | X |
| (g) remote control devices | 27 | 48 | X |
| (h) signal generators | 900 | 1100 | X |
| 5. Radio and low frequency, from: | | | |
| (d) signal generators | 200 | 330 | X |
| | 730 | 510 | Y |
| 6. Coherent electromagnetic radiation produced by stimulated emission, from: | | | |
| (a) lasers | | | |
| (1) art-form, experimental & educational devices | 8 | 27 | X |
| (5) communications transmitter | 22 | 65 | X |
| (6) range finding device | 68 | 200 | X |
| (7) other | 150 | 475 | X |
| | 80 | 175 | Y |

---

* X- extremely remote; Y - unlikely; Z- possible.

| Types of Radiation | (a) No. of products or radioactive sources on hand | (b) No. of agency/ contr. personnel potentially exposed | (c) Potential exposure of general public* |
|---|---|---|---|
| (b) masers | | | |
| (1) communication transmitters | 460 | 600 | X |
| (2) other | 35 | 50 | Y |
| C. Infrasonic, sonic, & ultrasonic vibrations, resulting from operations of an electronic circuit, such as: | | | |
| 2. Sonic from: | | | |
| (a) electronic oscillators | 525 | 1300 | X |
| 3. Ultrasonic from: | | | |
| (c) cleaners | 90 | 370 | X |
| (d) diagnostic & nondestructive testing equipment | 30 | 85 | X |
| (e) ranging & detection equipment including sonar | 38 | 240 | X |

---

*X - extremely remote; Y - unlikely; Z- possible.

Department of the Air Force - The USAF does use and possess the following radioactive materials and electronic products:

A.1 (a)(1) Radium - 4.2 Ci
(2) Radon and daughters - 0.1 Ci
(3) Other "natural" radionuclides - None
(4) Accelerator produced radionuclides:
a. $^{57}$Co - 0.16 Ci
b. $^{22}$Na - 0.0003 Ci
c. $^{208}$Po and $^{209}$Po - 0.025 Ci
d. Produced in Air Force Accelerators - Any radioisotope of atomic number 3-83, not more than 0.00001 Ci
(b) Approximately 20,000 agency personnel and no contractor personnel may be potentially exposed to this material.
(c) No members of the general public are exposed to the radioactive materials cited above.

A.2 (a)(1) X-Ray machines number approximately 1,017. This includes the following 954 X-Ray units used in USAF Medical facilities:

142 - 100 MA/100 KVP
106 - 50 MA/90 KVP
75 - 15 MA/90 KVP (Portable)
115 - 500 MA/150 KVP
115 - 300 MA/150 KVP
5 - Photoroentgen
396 - Dental

(2) Television receivers are procured on a local purchase or individual basis and are estimated to number in the thousands. The USAF Medical Service uses 350 cardiac monitoring scopes and cathode ray oscilloscopes are located on every USAF base.
(3) Neutron generators number approximately 6.
(4) Accelerators number approximately 19.
(5) Output device type equipment emitters, located in the continental United States, Hawaii, and Alaska number:

| | |
|---|---|
| Unknown | 521 |
| Magnetron | 6,184 |
| Klystron | 239 |
| Traveling-Wave Tube | 763 |
| Ceramic | 183 |
| Amplitron | 15 |
| Triode | 140 |
| Tetrode | 2 |
| Stabilotron | 0 |
| Lighthouse | 14 |
| Carcinatron | 4 |
| Varactor | 1,483 |
| Cavity Oscillator | 54 |
| Other | 21,762 |
| TOTAL | 31,364 |

(6) Electron microscopes number approximately 25.

(7) X-Ray diffraction instruments number approximately 80.

(b) Approximately 9,000 agency and no contractor personnel may be potentially exposed to energy from X-Ray machines. Approximately 1,000 agency personnel and 50 contractor personnel may be potentially exposed to other electronic products listed, excepting output device type equipment emitters which may potentially expose military department personnel in the tens of thousands.

(c) Members of the general public do not participate in military operations wherein X-rays are used. No members of the general public are knowingly exposed to the other electronic products cited above.

B.1 (a) The USAF does use and possess the following electronic products which are capable of producing ultraviolet light:

(1) Biochemical and medical analyzers number - 83

(2) Cosmetic and therapeutic lamps number - 325

  (1) UV light 90,000 microwatts - 45

  (2) UV light 1,000 microwatts - 168

  (3) UV light Dermalogical - 52

(3) Sanitizing and sterilizing devices - 35. These tubes are used in a research environment to reduce the airborne concentration of viable microorganisms.

(4) Other - Every Air Force base possesses and uses welding equipment. The Air Force Logistics Command activities utilize 350 welding units and 115 UV testing units. Total USAF welding and testing units are estimated to be in excess of 1000.

(b) Approximately 760 agency and contractor personnel are exposed to welding operations. Approximately 650 are exposed to ultraviolet testing operations. Total estimated number of personnel potentially exposed, considering all types of ultraviolet units listed, is greater than 2000.

(c) No members of the general public are knowingly exposed to ultraviolet light from USAF activities.

B.2 (a) Sources of intense incoherent visible light known to exist within the Air Force include in excess of 1000 carbon arc sources such as used in motion picture projectors, and 43 retinal detachment units.

(b) It is estimated that fewer than 1500 Air Force personnel may be exposed to carbon arc sources. Less than 50 Air Force personnel may potentially be exposed to retinal detachment units. No contractor personnel are known to be exposed.

(c) The general public is not known to be exposed to the sources mentioned.

B.3 (a) The USAF does use and possess electronic products which are capable of producing infrared light. Every Air Force base possesses and uses welding equipment. As indicated previously under Section B.1 covering ultraviolet, total USAF welding units are estimated to be in excess of 1000. Additionally, the Air Force Logistics Command activities utilize approximately 30 infrared paint drying ovens.

(b) Total estimated number of personnel potentially exposed to all types of infrared producing units listed is greater than 2000. Approximately 174 agency and contractor personnel are potentially exposed to infrared drying ovens.

(c) No members of the general public are exposed to infrared paint drying ovens.

B.4 (a) The USAF does use and possess the following microwave electronic products:

(1) Alarm systems - Approximately 100 - all operate at about 60 milliwatt output and are procured commercially from the following manufacturers:
   - (a) Alarmtronics Engineering, Newton, Mass. - 2.25 GHz
   - (b) Advanced Devices Laboratory, San Jose, Calif. - 10.7 GHz
   - (c) Pinkerton Electro-Security Co., Webster, Mass. - 0.4 GHz
   - (d) Johnson Service Co., Milwaukee, Wis. - 10.52 GHz
   - (e) Applied Devices Corp., Cottage-Point, N.W. - 1.92 GHz
   - (f) Sylvania Electronic System, Mt. View, Calif. - 1.68 GHz
   - (g) Devenco Incorporated, N.Y., N.Y. - 4.5 GHz

In addition to the above commercially manufactured alarm devices, the USAF has 94 AN/TPS-39 radars specifically developed for the USAF, which operate in frequency range 1700-1800 MHz. Tactical alarm systems are discussed in Rome Air Development Center (RADC) Report EME-TM-69-1. This RADC Report is calssified CONFIDENTIAL.

(2) Diathermy units - 133 - Diathermy (2450 MHz)

(3) Ovens - 260 Microwave Ovens
Litton Industries Model 500; 550; 500015; 611; 2450 MHz
Raytheon - Model Mark IV, IVB, IVD, V, and 6-20; 2450 MHz
Omnivend Corp. - Model 110B - 2450 MHz
Matsushita Electric Co., Ltd - Model 800; 2450 MHz
Tappan Electronics - Model R-1040 - 2450 MHz
Venda Mfg. Co. - Model 115 - 2450 MHz
Spudnut - 2450 MHz
Savio Mfg. Co. - 2450 MHz
Bruder and Co. - Model HE-1000 - 2450 MHz
General Electric - Model MW01C - 2450 MHz
Kwik Kooker - Model M-300 - 2450 MHz

(4) Medico-biological heaters - none identified.

(5) Microwave power generating devices - 1,100 USAF emitters above 400 MHz (excluding Radar)

(6) Radar Devices - 1779 - USAF Radars

(7) Remote Control Devices - This category has been included under B.4.c (generating devices) and B.5.c (RF power generators.

(b) The total number of agency and/or contractor personnel potentially exposed to all types of microwave devices considered under this section numbers in the tens of thousands.

(c) The general public is not known to be exposed to the microwave sources covered under this section on microwave.

B.5 (a) The USAF possesses and uses the following radio and low frequency generating devices:

(1) Cauterizers - 325 electrosurgical units

(2) Diathermy units - 69 - Diathermy units (13.56 MHz)

(3) Power generation and transmission equipment - 28,485 - USAF emitters below 400 MHz (excluding radar)

(b) The total number of agency and/or contractor personnel potentially exposed to all types of radio and low frequency devices considered under this section number in the tens of thousands.

(c) The general public is not known to be exposed to the sources referenced in this section.

B.6 (a) The USAF uses and possess the following
Laser/Maser Devices: Grand Total - 210

(1) Experimental and educational devices - 106 Total
Total includes:
94 - Continuous Wave - 1 mW - 1 KW
22 - Pulsed - 1 W - 1 MegaW

(2) Cauterizing, Burning, Welding - 18 Total
17 - Continuous Wave - 1 mW - 1 KW
1 - Pulsed - 1 W - 1 MegaW

(3) Range Finding - 101 Total
50 - Continuous Wave - 1 mW - 1 KW
11 - Pulsed - 1 W - 1 MegaW
40 - Q-switched - 1-10 MegaW

The above includes lasers of the following types: Ruby, Neodymium, Helium-Neon, Argon, Carbon Dioxide, Helium, Krypton, Gallium-Arsenide, and Nd-YAG.

(b) It is estimated that approximately 500 agency and 100 contractor personnel are directly associated with Laser/Maser projects.

(c) No members of the general public are knowingly exposed to USAF Laser/Maser activities.

C.1 (a) The only known source capable of producing infrasonics at sufficient intensity to warrant consideration in the USAF is concerned with ballistic missile launch operations during weapon system development testing and static firings. At the present time, only limited testing programs are involved at the Eastern Test Range, Cape Kennedy, and at the Western Test Range, Vandenberg Air Force Base.

(b) It is estimated that fewer than a thousand agency and contractor personnel are involved in these operations.

(c) Only the general public in the immediate proximity of the above-mentioned installations are potentially exposed to the testing programs when conducted.

C.2 (a) Several audio signal generators exist on each Air Force installation, accounting for an estimated total of over 1000.

(b) It is estimated that greater than 10,000 Air Force and contractor personnel are potentially exposed to this type of sonic oscillator.

(c) The general public is not known to be exposed to the source mentioned.

C.3 (a) Ultrasonic cleaning devices are used throughout the USAF. One major user is the Air Force Logistics Command which currently utilizes 118 of these devices. USAF Medical facilities use the following ultrasonic equipment:

102 - Ultrasonic instrument cleaners
68 - Ultrasonic therapy
10 - Ultrasonic diagnosis
260 - Ultrasonic prophylaxis

It is estimated that the total number used within the USAF is approximately 1000.

(b) There are approximately 10,000 Air Force and contractor personnel potentially exposed to ultrasonic cleaners.

(c) No members of the general public are knowingly exposed to USAF operated ultrasonic cleaners.

Department of Justice - (Bureau of Narcotics and Dangerous Drugs) -

(a) In addition to the more than 2,500 mobile and base radio stations which do emit some RF energy, the following are representative of the types of laboratory equipment used by the Bureau of Narcotics and Dangerous Drugs and I understand, to some degree, by the FBI.

(1) Six each, Tritiated Titanium Foil, Stainless Steel Backing, 150 millicuries.
(2) Six each, $^{63}$Ni Foil, Gold Backing, 15 millicuries (to be obtained).
(3) One each, X-Ray diffraction instrument.
(4) One each, Nuclear Magnetic Resonance Spectrometer (to be obtained).
(5) One each, Mass Spectrometer (to be obtained).
(6) One each, Oscilloscope (to be obtained).
(7) Eleven each, Ultraviolet Spectrophotometers.
(8) Six each, Fluorescence Spectrophotometers.

(9) Fifteen each, Portable UV source with long wave and short wave lamps.
(10) Twelve each, Infrared Spectrophotometers.

(b) Agency personnel who work with the radio equipment are, of course, exposed to any RF level energy. The numbers would be in the hundreds. For the laboratory personnel of the BNDD exposed to the 10 items listed above the following is the breakdown.

Approximately 100 people are exposed to the equipment listed in (a)(1) through (3) and (a)(6) through (10). For items (a)(4) and (5) the estimate is 25 persons.

(c) It is, of course, impossible to estimate the number of the general public who would be exposed to low level radiation from the mobile radios employed in vehicles of the Department of Justice. BNDD, after consulting with contractor engineers, has learned that radiation danger associated with this radio equipment is approximately 1/100,000 of that emitted by a normal TV transmitter antenna.

(Bureau of Prisons) -

(1) Radar - 380 persons exposed 40-200 minutes per week.
(2) Mobile Radio - 25,000 persons exposed few minutes to several hours per day.
(3) Television Receivers (B&W) - 23,000 persons exposed 1-4 hours per day.
(4) Test Instruments (10-300 MHz) - 30 persons exposed 1-4 hours per month.
(5) Various industry machinery - no estimate.
(6) X-ray machines (dental and medical) - 75,000 patients X-rayed per year. 2,500 patients fluoroscoped per year. 50 patients radiotherapy treated per year.
(7) Diathermy units - about 1-24 patient hours of use per day.
(8) Ultrasonic physiotherapy equipment - about 34 hours of use per week.
(9) Ultrasonic cleaners - about 24 hours of use per week.
(10) Ultraviolet lights - about 88 patient hours of use per day.
(11) Infrared heat lamps - about 180-240 patient hours of use per day.

Post Office Department - A blanket-type answer of YES could be made in answer to this question with a reasonable degree of certainty as to its veracity; however, it is impossible to attempt a definitive and quantitative answer to this question in the time allowed. The reason for this being that the Post Office Department conducts business with a great many concerns; to name a few:

(a) Approximately 12,000 Star Route contractors
(b) Every passenger-carrying railroad in the U.S.A.; a figure upwards of 560
(c) Every American steamship company
(d) All airlines operating in the U.S.A.

(e) 32,261 post offices at the close of 1968. Each post office is managed by a postmaster who conducts, generally speaking, an autonomous operation peculiar to that particular geographic location. Although the postmaster operates under the general policy directives of his respective postal region, he is held responsible for the performance and efficiency of his office. Consequently, each individual post office would need to be contacted in order to obtain the requested data. (See description of items in reply to Question 4, Appendix 6.)

While it is borderline for reporting, radiation detection equipment furnished by the Office of Civil Defense does include a detectable amount of radioactive material. The Post Office Department has geiger counters furnished by the Office of Civil Defense in about 650 cities, for radiological monitoring in the event of a nuclear attack. Each instrument has a very small beta source, generally uranium oxide, for determining whether the instrument is functioning properly. The beta source is fastened to the outside of the instrument case, under a decal which is very difficult to remove.

The amount of radioactive material is not sufficient to require an AEC license to possess the instruments, it being handled under a general license of the manufacturer.

These instruments are stored where they could not expose members of the public to radiation.

Department of the Interior - Yes; the overall summary information is provided by the following agencies of the Department of the Interior:

(1) Bureau of Indian Affairs
(2) Bonneville Power Administration
(3) Fish & Wildlife Service - Bureau of Commercial Fisheries; Bureau of Sport Fisheries and Wildlife
(4) Bureau of Reclamation
(5) Bureau of Land Management
(6) Geological Survey
(7) Office of Saline Water
(8) Federal Water Pollution Control Administration

Although the various estimates are not precise, they do provide some insight to the level of use of electronic products in Department of the Interior activities and the associated levels of occupational and general public exposure. See additional information for Bureau of Mines report.

## Department of the Interior Inventory of Electronic Products & Radioactive Sources

| Category | Estimated Number of Units | Estimated Number of Personnel Exposed* | Possible General Public Exposed** |
|---|---|---|---|
| I. Ionizing Electromagnetic & Particulate Radiation | | | |
| A. Radioactive Materials (Not regulated by the Atomic Energy Commission) | | | |
| 1. Radium | | | |
| a. Separate calibration sources (external from the instruments) | 4 | < 10 | No |
| b. Built-in sources (liquid scintillation counters, gas chromatographs, etc.) | 3 | Not reported | |
| 2. Radon & daughters | | | |
| None reported | | | |
| 3. Other natural radionuclides | | | |
| $U_3O_8$ reference standards | 2 | < 5 | No |
| 4. Accelerator produced radionuclides | | | |
| None reported | | | |
| 5. Other | | | |
| Radium-beryllium source | 2 | 6 | No |
| B. Electronic Products | | | |
| (1) X-ray machines | 8 | 27 | No |
| (2) Television receivers (black & white) | 30 | 60 to 70 | Minimal |
| (3) Neutron generators | | | |
| None reported | | | |
| (4) Accelerators | | | |
| None reported | | | |

| Category | Estimated Number of Units | Estimated Number of Personnel Exposed* | Possible General Public Exposed** |
|---|---|---|---|
| (5) Klystron tubes | 736 | 69 | No |
| (6) Electron microscopes | 5 | 15 | No |
| (7) X-ray diffraction instruments | 50 to 60 | 300 to 500 | No |
| (8) Electronic beam welders | | | |
| None reported | | | |
| (9) Other | | | |
| (a) Electron microprobes | 5 | 30 | - |
| (b) Food irradiator | 1 | 7 | Minimal |
| (c) Oscilloscopes | 6 | 12+ | No |
| (d) DC electronic pulsating devices at sea lamprey weirs | 5 | 15 | Minimal |
| II. Non-Ionizing Electromagnetic Radiation | | | |
| A. Ultraviolet from: | | | |
| (1) Biochemical & medical analyzers | | | |
| None reported | | | |
| (2) Cosmetic & therapeutic lamps | | | |
| None reported | | | |
| (3) Sanitizing & sterilizing devices | 167 | 217 | Minimal |
| (4) Other | | | |
| (a) Lamps & light banks | 9 | 9+ | No |
| (b) Emission spectrographs | 6 | 10+ | Minimal |
| (c) Spectrophotometers | 19 | 42+ | Minimal |
| (d) Fluorometers, fluorescent spectrophotometers and atomic absorption spectrophotometers | 14 | 32+ | No |
| (e) Phase dark field microscope | 1 | 4 | Minimal |

| Category | Estimated Number of Units | Estimated Number of Personnel Exposed* | Possible General Public Exposed** |
|---|---|---|---|
| B. Visible from: | | | |
| (1) White light devices | | | |
| None reported | | | |
| (2) Other | | | |
| (a) Spectrophotometers | 10 | Not reported | No |
| (b) Electric arc welders | 450 | 350 | No |
| (c) Xerox copiers | 2 | 20+ | No |
| C. Infrared from: | | | |
| (1) Alarm systems | | | |
| None reported | | | |
| (2) Dryers, ovens, & heaters | 50 to 200 | 50 to 200 | No |
| (3) Other | | | |
| (a) Spectrophotometers | 9 | 15+ | Minimal |
| (b) Total organic carbon analyzers | 2 | 11 | No |
| (c) Infracords | 2 | Not reported | No |
| (d) Lamps & light bank | < 10 | < 15 | No |
| (e) Unidentified small sources in laboratory equipment | Several | 2 | No |
| D. Microwave from: | | | |
| (1) Alarm systems | | | |
| None reported | | | |
| (2) Diathermy units | | | |
| None reported | | | |
| (3) Dryers, ovens, & heaters | 26 | 40 | Minimal |

| Category | Estimated Number of Units | Estimated Number of Personnel Exposed* | Possible General Public Exposed** |
|---|---|---|---|
| (4) Medico-biological heaters | | | |
| None reported | | | |
| (5) Microwave power generating devices | 62 to 186 | 15 | No |
| (31 stations, each containing 2 to 6 one-watt transmitters) | | | |
| (6) Radar devices | 48 | 160 | Minimal |
| (7) Remote control devices | | | |
| None reported | | | |
| (8) Signal generators (7-8 GHZ) | 26 | 69 | No |
| (9) Other | | | |
| None reported | | | |
| E. Radio & Low Frequency, from: | | | |
| (1) Cauterizers | | | |
| None reported | | | |
| (2) Diathermy units | | | |
| None reported | | | |
| (3) Power generation & transmission equipment | | | |
| (a) Bureau of Reclamation | | 1500 | No |
| (i) Hydroelectric generating installations (7,258,722 kw installed capacity) | 51 | | |
| (ii) Substations (total transfer capacity of 17,693,737 kva) | 309 | | |
| Note: Reclamation power transmission systems consist of 15,378 miles lines varying from 13.8 kv to 345 kv capacity. | | | |

| Category | Estimated Number of Units | Estimated Number of Personnel Exposed* | Possible General Public Exposed** |
|---|---|---|---|
| (b) Other Dept. of Interior agencies | 66 | 150 | Minimal |
| (4) Signal generators | 11 | 3+ | No |
| (5) Other | | | |
| (a) Bureau of Reclamation | | | |
| (i) VHF & UHF radio transmitters (stationary & mobile units) | 1000 | 40 | No |
| (b) Other agencies | | | |
| (i) Portable & base radio transmitters | 18 | 14+ | No |
| (ii) Tissue ashing devices | 2 | 13 | Minimal |
| (iii) Nuclear magnetic resonance spectrometer | 1 | Not reported | No |
| (iv) Electroshocking fishing apparatus | 1 | 8 | No |
| F. Coherent electromagnetic radiation produced by stimulated emission, from: | | | |
| (1) Lasers | | | |
| (a) Art-form, experimental & educational devices<br>None reported | | | |
| (b) Biomedical analyzers<br>None reported | | | |
| (c) Cauterizing, burning, & welding devices<br>None reported | | | |
| (d) Cutting & drilling devices<br>None reported | | | |
| (e) Communications transmitters<br>None reported | | | |

| Category | Estimated Number of Units | Estimated Number of Personnel Exposed* | Possible General Public Exposed** |
|---|---|---|---|
| (f) Range finding devices | | | |
| (i) Lasers | 13 | 114 | Minimal |
| (ii) Tellurometers | 15 | 40 | Minimal |
| (iii) Electrotapes | 18 | 40 | Minimal |
| (g) Other | | | |
| None reported | | | |
| (2) Masers | | | |
| None reported | | | |
| G. Infrasonic, sonic, & ultrasonic vibrations, resulting from the operation of an electronic circuit, such as: | | | |
| 1. Infrasonic, from: | | | |
| (a) Vibrators | 1 | 3 | Minimal |
| (b) Other | | | |
| None reported | | | |
| 2. Sonic, from: | | | |
| (a) Electronic oscillators | | | |
| None reported | | | |
| (b) Other | | | |
| (i) Sonic shaker | 1 | 3 | Minimal |
| 3. Ultrasonic, from: | | | |
| (a) Cauterizers | | | |
| None reported | | | |
| (b) Cell & tissue disintegrators | 2 | 6 | Minimal |

| Category | Estimated Number of Units | Estimated Number of Personnel Exposed* | Possible General Public Exposed** |
|---|---|---|---|
| (c) Cleaners | 10 to 20 | 67 | No |
| (d) Diagnostic & nondestructive testing equipment | 2 | 5 | Minimal |
| (e) Ranging & detection equipment | 20 | 58 | Minimal |
| (f) Other | | | |
| (i) Ultrasonic generators | 5 | 5$^{+}$ | Minimal |

---

* The superscript, +, indicates that one or more of the agencies reporting the use and possession of the particular unit did not estimate the number of personnel exposed to the emitted radiation. However, such incomplete reporting is not anticipated to introduce gross errors in the estimates of occupational exposure.

** Minimal indicates that one or more of the agencies reporting the use and possession of the particular unit considered exposure of the general public to be a possibility, but virtually nil or quite limited.

(Bureau of Mines) -

(a) Enclosed is an inventory listing and a brief description of each radioactive material and electronic product item corresponding to the types listed in Attachment I. See Enclosure 13, Inventory List: Radioactive Materials and Electronic Products.

(b) The number of Bureau personnel potentially exposed to radiation from each source is shown in Enclosure 13, List of Radioactive Materials and Electronic Products. The list consists of 403 types of electronic products or radioactive sources covering 23 different locations with potential exposure of 937 employees.

(c) Public (statutory): Uranium miners and general public in the areas of mines or processing mills. Bureau (in-house) activities: No persons except Bureau employees. Adequate safeguards are in effect to protect authorized visitors.

## INVENTORY OF RADIOACTIVE MATERIALS AND ELECTRONIC PRODUCTS: BUREAU OF MINES:

Following is a list of Bureau items corresponding to those listed in Attachment I:

A. 1. Radioactive materials other than materials regulated under the Atomic Energy Act of 1954:

(a) Radium

| Description | Curies | Maximum energy (mev) | Quantity | Form | Potential personnel exposure |
|---|---|---|---|---|---|
| Alphatron Gauge | 0.5 mc | 4.7$\alpha$ -- 0.18$\gamma$ | 0.0005 gm | Solid salt | 2 |
| Radium | 10 mc | 4.8$\alpha$ -- 0.19$\gamma$ | 10 mg | Sealed source | 3 |
| Radium | .100 mc | .188 | -- | Sealed source | 3 |
| Radium | <.005 mc | 4.77 | <1 gm | -- | 2 |
| Alphatron Gauge | 100 mc | -- | -- | Sealed source | 3 |
| Radium (NBS) | -- | -- | 100 mg | Sealed source | 2 |
| Level Gauge | 0.95 mc | Spectrum | -- | Sealed source | 2 |
| Pipe Gauge | 0.95 mc | Spectrum | -- | Sealed source | 2 |
| Radium Button | 1 µc | Spectrum | -- | Disk | 1 |
| Radium Button | 1 µc | Spectrum | -- | Disk | 1 |
| Radium Button | 1 µc | Spectrum | -- | Disk | 1 |
| Radium$^{226}$ | -- | -- | -- | -- | 2 |
| Radium | -- | -- | -- | -- | 2 |
| Radium | .100 mc | .188 | -- | Sealed source | 2 |

A. 1. (b) Radon and Daughters:

Uranium ore, ± 5 tons, containing approximately 0.2 percent $U_3O_8$ -- approximately 1 mc per pound. Potential personnel exposure: 5

Uranium ore, 100 pounds. Potential personnel exposure: 2

A. 1. (c) Other "Natural" Radionuclides:

Thorium-230, 6 sources, 4.6 mev alpha at 3,000 c.p.m. Personnel exposure: 12 periodically.

(continued on next page)

A. 1. (c) Other "Natural" Radionuclides (continuation):

| Description | Curies | Maximum energy (mev) | Quantity | Form | Potential personnel exposure |
|---|---|---|---|---|---|
| Uranium-238 | .28 mc | 4.2 | 838 gm | -- | 2 |
| Thorium-228 | 28.5 mc | 5.4 | 5 gm | Sealed | 2 |
| Ore, ±1% $ThO_2$ | 1 mc/lb. | -- | 200 lb. | Ore in bbl. | 5 |
| Thorium, natural | -- | -- | 6 lb. | Ore | 1 |
| Uranium, natural | -- | -- | 6 lb. | Ore | 1 |
| Uranium (NBS) | 1 mc | -- | -- | Sealed | 2 |
| Uranium (NBS) | 1 mc | -- | -- | Sealed | 2 |

A. 1. (d) Accelerator Produced:

| Description | Curies | Maximum energy (mev) | Quantity | Form | Potential personnel exposure |
|---|---|---|---|---|---|
| Cobalt-57 | 20 mc | .136 | -- | Sealed | 2 |
| Cobalt-57 | 2 mc | .136 | -- | Sealed | 1 |
| Cobalt-57 | 2 mc | .136 | -- | Sealed | 1 |
| Cobalt-57 | 1 mc | .136 | -- | Sealed | 1 |
| Cobalt-57 | 1 mc | .136 | -- | Sealed | 1 |
| Cobalt-57 | 1 mc | .136 | -- | Sealed | 1 |
| Cobalt-57 | 50 mc | .136 | -- | Sealed | 2 |
| Gold-195 | 2.2 mc | .13 | -- | Solution | 3 |
| $Ga^{68}Ge^{68}$ | 1 mc | 1.1 | 30 ml | Liquid | 1 |
| $Ga^{68}Ge^{68}$ | 22 mc | 1.1 | -- | Solution | 1 |
| $Ga^{68}Ge^{68}$ | 22 mc | 1.1 | -- | Solution | 1 |
| Protactinium | $.43x10^{-5}$ mc | 2,32 | -- | Sealed | 1 |
| Cadmium-109 | 10 µc | .088 | -- | Sealed | 1 |
| Iron-55 | 50 µc | .0059 | -- | Sealed | 1 |
| Germanium-68 | -- | -- |  | Sealed | 1 |

A. 1. (e) Other (except non-licensed sources)

| Description | Curies | Maximum energy (mev) | Quantity | Form | Potential personnel exposure |
|---|---|---|---|---|---|
| Scintillation stds. H-3, $Cl^{36}$ and $C^{14}$ | 1 uc | 0.75 | -- | Liquid | 1 |
| NBS Standard Thorium$^{228}$ | 1 uc | 2.6 | -- | Disk | 1 |
| Abbott stds.-- Plastics | 1 mc | Cal. stds. | -- | Disk | 1 |
| NBS Standards | 1 mc | Cal. stds. | -- | Sealed | 1 |

A. 2 (a) X-Ray Machines:

| Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|
| X-ray Spectrograph | Picker | XRD-6 | 7.5 KV | 2 |
| X-ray Spectrograph | GE | XRD-3 | 50 KV | 2 |
| X-ray Machine | Picker | T-55 | 90 KV | 3 |
| X-ray Spectrograph | Picker | 3668 | 60 KV | 7 |
| X-ray Spectrograph | Phillips | 12405 | 60 KV | 5 |
| X-ray Spectrograph | Phillips | 52254 | 60 KV | 6 |
| X-ray Spectrograph | Phillips | 42202 | 60 KV | 3 |
| X-ray Spectrograph | Custom | -- | 50 KV | 1 |
| X-ray Probe | Custom | -- | .01 ma | -- |
| A-L Spectrograph | Varian | 120 | 1 KV | 2 |
| X-ray Machine | Holger A | 1652 | 200 KV | -- |
| X-ray Spectrograph | GE | XRD-5 | 50 KV | 3 |
| X-ray Spectrograph | GE | XRD-6 | 75 KV | 3 |
| X-ray Fluorescence | Phillips | 19010011 | -- | 1 |
| X-ray Microprobe | Phillips | AMR/3 | -- | 2 |
| X-ray Generator | Phillips | 12010200 | 50 KV | 1 |
| X-ray, Dental | Weber | 7A | -- | 2 |
| X-ray Generator | Phillips | 12045 | 50 KV | 6 |
| X-ray Probe | Material Analysis | 400 | 50 KV | 3 |
| X-ray Spectrometer | Phillips | -- | 2.3 KV | 1 |
| X-ray Spectrometer | Phillips | -- | 2.5 KV | 1 |
| X-ray, Medical | Picker | -- | 75 KV | 2 |
| X-ray Unit | Picker | -- | 160 KV | 6 |
| Flash X-ray | Febertron | 701-266 | 600 KV | 2 |
| Flash X-ray | Flexitron | -- | 300 KV | 2 |
| Flash X-ray | Flexitron | -- | 300 KV | 2 |
| X-ray Fluorescence | Phillips | 360 | 120 KV | 3 |

A. 2. (b) Television Receivers:

| Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|
| Television receiver | RCA | -- | 110 V | 4 |
| Television receiver | Sylvania | VMR-14 | 110 V | 10 |
| Television receiver | Gen. Precision | "Conroi" | 110 V | 5 |
| Television receiver | RCA | 17-S-350 | 115 V | 5 |
| Television receiver | -- | -- | 115 V | 2 |
| Television receiver | -- | -- | 115 V | 2 |
| Television monitor | Hydro-Prod. | RM-101 | -- | 4 |
| Television monitor | Concord | T-400 | -- | 3 |
| Television receiver | Admiral | 22848 | 115 V | 1 |
| Television receiver | Admiral | 38021 | 115 V | 2 |
| Television receiver | Sony | 43287 | 115 V | 1 |
| Television receiver | Panasonic | AN-22 | 115 V | 2 |
| Television receiver | Olson | TV-122 | 117 V | 6 |

A. 2. (c) Neutron Generators:

| Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|
| Neutron generator | Texas Nuclear | 9500 | 14 mev (n)<br>150 KVA | 2 |
| Neutron generator | Texas Nuclear | 9500 | 14 mev (n)<br>150 KVA | 2 |

A. 2. (d) Accelerators:

| Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|
| Accelerator | Accelerators, Inc. | A.I.-1 | 2,000 V | 5 |

A. 2. (e) Klystron Tubes:

None.

### A. 2. (f) Electron Microscopes:

| Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|
| Electron Microscope | RCA | EMU-3H | 100 KV | 2 |
| Electron Microscope | Phillips | EM-100 | 100 KV | 2 |
| Electron Microscope | ARL | EMX | 50 KV | 2 |
| Electron Microscope | Phillips | EM-100 B | 100 KV | 1 |
| Electron Microscope | El. Optics, Ltd. | JSM 2 | 2.5 KV | 6 |
| Electron Microscope | Norelco | EM75c | 1500 W | 3 |
| Electron Microscope | RCA | EMU-3f | 2--5 KV | 2 |

### A. 2. (g) X-ray Diffraction Instruments:

| Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|
| X-ray Diffraction | GE | XRD5 | 60 KV | 2 |
| X-ray Diffraction | GE | XRD5 | 60 KV | 2 |
| X-ray Diffraction | GE | XRD3 | 50 KV | 2 |
| X-ray Diffraction | Norelco | 12045 | 50 KV | 2 |
| X-ray Diffraction | Norelco | 12045 | 60 KV | 5 |
| X-ray Diffraction | Norelco | 12044 | 60 KV | 5 |
| X-ray Diffraction | Phillips | E58001 | 60 KV | 5 |
| X-ray Diffraction | Phillips | 12045 | 60 KV | 2 |
| X-ray Diffraction | Phillips | 12045 | 60 KV | 2 |
| X-ray Diffraction | Phillips | 12045 | 60 KV | 1 |
| X-ray Diffraction | GE | XRD-5 | 75 KV | 2 |
| X-ray Diffraction | Phillips | XRD-5 | 60 KV | 2 |
| X-ray Diffraction | GE | XRD-3 | 50 KV | 3 |
| X-ray Diffraction | GE | 516 E 721 | 50 KV | -- |
| X-ray Diffraction | Phillips | 15010000 | 50 KV | 2 |
| X-ray Diffraction | GE | XRD 6 | 50 KV | 3 |
| X-ray Diffraction | GE | XRD 6 | 50 KV | 4 |
| X-ray Diffraction | Siemans | K-4 | 4 KV | 2 |
| X-ray Diffraction | Picker | 795 | 900 W | 2 |

A. 2 (h) Electron Beam Welders

| Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|
| Electron Gun | Brad Thompson | 770-10-SS | 50 W | 3 |

A. 2 (i) Other

| Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|
| Wave Welder | Miller | BW 330 MKP | 43.2 KVA | 3 |
| Oscilloscope | Heathkit | -- | 2.5 MC | 2 |
| Oscilloscope | Hewlett-Packard | 122A | 4.5 MC | 5 |
| Oscilloscope | Tektronix | 535 | 4.5 MC | 2 |
| Oscilloscope | Hewlett-Packard | 120 AR | 1.0 MC | 2 |
| Oscilloscope | Hewlett-Packard | 130 C | 1.0 MC | 4 |
| Oscilloscope | Electronic Instr. | 460 | 400.0 KC | 5 |
| Electron Beam Furnace | Custon | -- | 2 - 110 KW | 13 |
| Mass Spectrometer | Avco | 9001 | 10 KV | 2 |
| Image Convertor | RCA | 6032 A | 1 W | 2 |
| Image Convertor | RCA | 6032 A | 1 W | 2 |
| Image Convertor | RCA | 6032 A | 1 W | 1 |
| Oscilloscope | Simpson | 458 | 300 KC | 3 |
| Fluorometer | Beckman | 772000 | -- | 2 |
| Silicon Rectifier | Res. Cottrell | OA | 50 KV | 6 |
| Oscilloscope | Hewlett-Packard | 175 A | -- | 6 |
| Oscilloscope | Tektronix | 533 A | 4.5 MC | 2 |
| Oscilloscope | Tektronix | -- | 4.5 MC | 2 |

B. Non-ionizing electromagnetic radiation:

1. Ultraviolet, from

B. 1. (a) Biochemical and Medical Analyzers: None

B. 1. (b) Cosmetic and Therapeutic Lamps: None

B. 1. (c) Sanitizing and Sterilizing Devices: None

B. 1. (d) Other:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Ultraviolet | Magnaflux | ZB.23Z | 100 W | 2 |
| 5 | Ultraviolet | Ultraviolet Pdts. | -- | 6 V | 2 |
| 5 | Ultraviolet | Ultraviolet Pdts. | 3L2357 | 9 W | 3 |
| 1 | Ultraviolet | Eastern Corp. | SCT-1 | 110 V | 3 |
| 1 | Deuterium Lamp | Oriel Optics | C.75.12 | 30 W | 2 |
| 2 | Mineralight | Ultraviolet Pdts. | SL 3660 | -- | 1 |
| 1 | Ultraviolet | Beckman | D K 2 | 115 V | 2 |
| 1 | Ultraviolet | Ultraviolet Pdts. | UVS 11 | 117 V | 1 |
| 1 | Recording Oscillograph | Bell & Howell | 5-124 | -- | 6 |
| 1 | Plasma Torch | Plasmadyne | SG-1 | 14 KW | 4 |
| 1 | Zyglo Testing Kit | Magnaflux | H38-4GS | 100 W | 10 |
| 2 | Spectrophotometer | Beckman | -- | 60 W | 4 |
| 1 | Spectrograph | Bausch & Lomb | 2475 | 6000 W | 3 |
| 1 | Ultraviolet Lamp | Ultraviolet Pdts | UVS-12 | 20 W | 2 |
| 1 | Ultraviolet Lamp | B.K. & H Co. | B100 | 60 cycles | 5 |
| 1 | Ultraviolet Lamp | Ultraviolet Pdts. | J-330 | -- | 5 |
| 1 | Ultraviolet Lamp | GE | F 40 T | 80 W | 5 |

B. 2. Visible, from

B. 2. (a) White Light:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Radiant Heat Projector | Dyna-Lume | 315-2 | 600 W | 2 |
| 2 | Arc Source | Nat. Spectrographic | 110-91 | 8 KVA | 3 |
| 1 | Arc Source | Nat. Spectrographic | 110-1 | 12 KVA | 3 |

B. 2. (b) Other:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 2 | Spectrophotometer | Bausch & Lomb | 325 | 1,000 mm | 6 |
| 1 | Welder | Lincoln | SAE 200 | 200 V | 1 |
| 4 | Xenon Flash Tube | Sylvania | R4336 | 10,000 W | 5 |
| 1 | Arc Welder | Air Products | AP 250 | 30 V-250 amp | 1 |
| 1 | Spectrophotometer | Beckman | -- | 60 W | 2 |

B. 3. Infrared:

B. 3. (a) Alarm Systems: None

B. 3. (b) Dryers, Ovens, and Heaters:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 4 | Oven | Custom | -- | 10 KW | 2 |
| 1 | Heater | Custom | -- | 2 KW | 2 |
| 1 | Dryer | Custom | -- | 1.5 KW | 2 |
| 2 | Furnace | Instron | X5 | 1725 W | 1 |
| 1 | Furnace | Marshall | -- | 1650 W | 1 |
| 1 | Furnace | Marshall | -- | 2300 W | 1 |
| 2 | Furnace | Marshall | -- | 1760 W | 1 |
| 2 | Furnace | Arcweld | F6 | 2000 W | 1 |
| 2 | Furnace | Satec | F6 | 2000 W | 1 |
| 1 | Oven | Blue Line | OV18 | 1750 W | 1 |
| 1 | Furnace | Hevi-Duty | HDT | 22 KW | 5 |
| 1 | Furnace | Harper | HU | 24 KW | 5 |
| 1 | Furnace | Hevi-Duty | HDT | 42 KW | 2 |
| 1 | Furnace | Hevi-Duty | M | 7.5 KW | 2 |
| 1 | Furnace | Hevi-Duty | HD | 7 KW | 2 |
| 1 | Furnace | Lucifer | TUP-3 | 20 KW | 5 |
| 1 | Furnace | Eisler | CPC | 12 KVA | 2 |
| 1 | Furnace | Lindberg | EH | 15 KW | 3 |
| 1 | Heater | Aitken | SH135431 | 13.5 KW | 4 |

B. 3. (c) Other:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Infrared Analyzer | Beckman | LB21 | -- | 8 |
| 1 | Infrared Analyzer | Lira | 200 | -- | 8 |
| 1 | Infrared Analyzer | Perkins-Elmer | 337 | -- | 2 |
| 1 | Infrared Analyzer | MSA | 200 | -- | 7 |
| 1 | Infrared Spectrophotometer | Perkins-Elmer | 457 | -- | 2 |
| 1 | Infrared Spectrophotometer | Cenco | -- | 125 W | 6 |
| 1 | Infrared Spectrophotometer | Beckman | 215A | 160 W | 3 |
| 1 | Infrared Spectrophotometer | Beckman | 315 | 530 W | 3 |
| 1 | Infrared Spectrophotometer | Beckman | 2110-1R5 | -- | 3 |
| 1 | Infrared | MSA | 300 | 200 W | 3 |
| 7 | Dryers (lamps) | GE lamps | -- | -- | 7 |
| 1 | Spectrophotometer | Perkins-Elmer | 21 | -- | 3 |
| 1 | Spectrophotometer | Perkins-Elmer | 521 | -- | 3 |
| 1 | Spectrophotometer | Perkins-Elmer | 621 | -- | 3 |
| 1 | Spectrophotometer | Perkins-Elmer | 137B | 175 W | 1 |
| 1 | Spectrophotometer | Bausch & Lomb | 20 | 340-950 mu | 2 |
| 1 | Spectrophotometer | Perkins-Elmer | FIS-3 | 250 W | 6 |
| 1 | Spectrophotometer | Perkins-Elmer | 112 | 250 W | 1 |
| 1 | Spectrophotometer | Beckman | IR-4 | 250 W | 1 |
| 1 | Spectrophotometer | Beckman | IR-8 | 200 W | 3 |
| 1 | Spectrophotometer | Acton Lab. | FIR-64 | 250 W | 6 |
| 1 | Spectrophotometer | Perkins-Elmer | -- | 60 W | 2 |
| 1 | Spectrophotometer | Perkins-Elmer | 21 | 44 W | 2 |
| 1 | Spectrophotometer | Perkins-Elmer | 21 | 90 W | 2 |
| 1 | Spectrophotometer | MSA | 200A | -- | 4 |
| 1 | Spectrophotometer | Perkins-Elmer | 21 | -- | - |
| 1 | Furnace | Research, Inc. | E4-16 | 6200 W | 4 |

B. 4. Microwave:

B. 4. (a) Alarm Systems: None

B. 4. (b) Diathermy:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Diathermy Unit | Birtcher Crystal | 800 | 75 W | 1 |
| 1 | Diathermy Unit | Birtcher Crystal | MF49 | 560 W | 1 |

B. 4. (c) Oven:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Oven | Raytheon Co. | 1162 | -- | 2 |

B. 4. (d) Medico-biological Heaters: None

B. 4. (e) Microwave Power Generating Devices:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Pulsed Signal | Applied Microwave | PH20K | 25 KW | -- |
| 1 | Generators | Varian | PPS2.5A | 6.6 KVA | -- |
| 1 | Generator | Raytheon | CMD-10 | 125 W | -- |
| 1 | Generator | Raytheon | KV-104A | 100 W | 5 |
| 1 | Generator | Varian | PPS-2.5A | 1000 W | 1 |
| 1 | Generator | Cober Electronics | MP2.5 | -- | 2 |

B. 4. (f) Radar Devices:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Radar | Bendix | FPS-14 | 460 KW | -- |
| 1 | Radar | Decca Co. | 101 | 3 KW | 2 |
| 1 | Radar | Ratheon | 725 | 30 KW | 3 |
| 1 | Radar | Decca Co. | TM629 | 25 KW | 2 |

B. 4. (g) Remote Control Devices: None

B. 4. (h) Signal Generators:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Signal Generator | Electronic Instruments | 320-322 | 102 MC | 2 |
| 1 | Signal Generator | Hewlett Packard | H81 | 100 MW | 2 |
| 1 | Signal Generator | Hewlett Packard | 200CD | 1 W | 2 |

B. 4. (i) Other: None

B. 5. Radio and Low Frequency:

B. 5. (a) Cauterizers: None

B. 5. (b) Diathermy Units: None

B. 5. (c) Power Generation and Transmission Equipment:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | High Frequency Induction Furnace | Leco | 521 | 1.5 KW | 7 |
| 1 | High Frequency Induction Furnace | Leco | 523 | 1.5 KW | 7 |
| 1 | Induction Generator | Taylor-Winfield | C-2000-LF | 20 KW | 6 |
| 1 | Induction Heating Generator | Induction Heating Co. | Thermonic-50 | 1000 KW | 3 |
| 1 | Induction Heater | Taylor-Winfield | 50 | 1 KW | 3 |
| 1 | Corona Reaction Experimental Unit | Corona | 10.4 KVA | 10.4 KVA | 2 |
| 1 | Induction Generator | Ohio Crankshaft | -- | -- | 1 |
| 1 | Two-way radio | Motorola | J44AA8 | 15 W | 3 |
| 6 | Generators, Induction | Lepel & Radio Freq. Corp. | -- | -- | 10 |
| 3 | Generators (ASC) | GE & Tocco | -- | 50--100 | 7 |
| 1 | Vacuum Furnace | NRC | 87450 | 20 KW | 5 |
| 1 | Vacuum Furnace | Ajax | -- | 60 KVA | 5 |
| 1 | Vacuum Furnace | Ajax | N | 20 KW | 5 |
| 1 | Electronic Air Cleaner | Trion | I | 20 KV | 10 |

### B. 5. (c) Power Generation and Transmission Equipment (continuation):

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Radio Transmitter | Westinghouse | AN/WRT-2 | 1 KW | 1 |
| 1 | Radio Transmitter | R. F. Communications Co. | SB-6C | 1 KW | 2 |
| 1 | Radio Transmitter | Collins Mfg. | 32-S-3 | 100 W | 1 |
| 1 | Linear Power Amplifier | Drake Mfg. Co. | L-4 | 1 KW | 2 |

### B. 5. (d) Signal Generators:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 2 | Signal Generator | RCA | 960 | -- | 2 |
| 2 | Signal Generator | Heathkit | SG-8 | -- | 2 |
| 1 | Signal Generator | Paco Electronics | RF | -- | 5 |
| 1 | Signal Generator | Paco | RF | 200 KHZ--900 MHZ | 2 |
| 1 | Signal Generator | Paco | -- | 5 HZ-600 KHZ | 2 |
| 1 | Signal Generator | -- | -- | 20 HZ-20 KZ | 2 |
| 1 | Signal Generator | Hewlett Packard | 608 | $3x10^{-3}$ W | 5 |
| 1 | Signal Generator | Westinghouse | -- | 10 KW | 3 |
| 1 | Signal Generator | Hewlett Packard | 606B | 50 KHZ | 2 |

### B. 5. (e) Other:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Induction Furnace | Inductothern | 900 | 50 KW | 7 |
| 1 | Induction Furnace | Inductothern | 83854-2 | 600 V | 5 |
| 1 | High Frequency Converter | Ajax | 115483 | 220 V | 3 |
| 1 | High Frequency Converter | Ajax | 724536 | 440 V | 3 |
| 1 | High Frequency Converter | Inductothern | -- | 15 KW | 4 |
| 1 | "Orb-ion Pump" | Norton Res. Co. | 0204-1 | 5000 W | 5 |

B. 5. (e) Other (continuation):

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Induction Furnace | Ohio Crankshaft | OL-159 | 15 KW | 2 |
| 1 | Transformer | Ohio Crankshaft | OL-68 | 15 KW | 2 |
| 1 | Induction Furnace | Ajax Electric | -- | 3 KVA | 2 |
| 1 | Induction Heating | Scientific Elec. | WC-10 | 10 KW | -- |
| 1 | Induction Heating | Lepel | T5N3-S | 6 KVA | -- |
| 1 | Induction Heating | Cycledyne | C-200 | 20 KV | -- |
| 1 | Electronic Asher | Tracerlab | 600-L | 300 W | 6 |
| 1 | "Q" Meter | Heath Co. | -- | 110 V | 3 |
| 1 | Induction Heater | Radio Freq. Co. | 20,000 | 20 KW | 4 |
| 2 | Radio | Tech. Mat. Corp. | AN/UKRT | 1 KW | 2 |
| 1 | Radio Frequency Reactor | Coleman | 40 | 90 W | 1 |
| 1 | 2-way Radio | GE | ET72A | 50 W | 2 |
| 1 | 2-way Radio | Motorola | T-51GV-1 | 50 W | 4 |
| 1 | 2-way Radio | Johnson-Messenger | III | 3 W | 4 |
| 1 | 2-way Radio | Johnson | 242-106-102 | 1 W | 6 |
| 1 | 2-way Radio | Johnson-Messenger | III | 3 W | 2 |
| 1 | Induction Heating | Lepel | T-20-3 | 20 KW | 2 |
| 1 | Pulse Generator | -- | -- | 700 W | 2 |

B. 6. Coherent Electromagnetic Radiation Produced by Stimulated Emission:

B. 6. (a) Lasers:

(1) Art-form, experimental and educational devices: None

(2) Biomedical analyzers: None

(3) Cauterizing, burning, and welding devices: None

(4) Cutting and drilling devices: None

(5) Communications transmitters: None

(6) Range finding devices: None

(7) Other: (See tabulation, next page)

B. 6. (a) Lasers (continuation):

B. 6. (a) (7) Other (continuation):

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Laser | Quantum-Physics | L-32 | 1 MW | 2 |
| 1 | Laser | Jarrell-Ash | Mark II | 1.0 joules | 2 |
| 1 | Laser | Electro-Nuclear | LS32 | 0.5 MW | 4 |
| 1 | Laser | Trian | LS-3 | 3 joules | 1 |
| 1 | Laser | Coherent Rad. Lab. | 40 | 100 W | 4 |
| 1 | Laser | Resalab, Inc. | XL3335 | 4 MW | 1 |
| 1 | Laser | Westinghouse | M304 | 30 joules | 4 |
| 1 | Laser | Perkins-Elmer | 75 | 1 MW | 4 |
| 1 | Laser | Holobeam, Inc. | S300 | 8 joules | 4 |
| 1 | Laser | University Lab. | 240 | 1 MW | 3 |
| 1 | Laser | Optics Tech. | 170 | 1 MW | 2 |
| 1 | Laser | Westinghouse | -- | 7 joules | 1 |
| 1 | Laser | Seed Electronic | -- | 10 joules | 1 |

B. 6. (b) Masers:

B. 6. (b) (1) Communication transmitters: None

B. 6. (b) (2) Other: None

C. Infrasonic, Sonic, and Ultrasonic Vibrations:

C. 1. Infrasonic:

C. 1. (a) Vibrators: None

C. 1. (b) Other: None

C. 2. Sonic:

C. 2. (a) Electronic oscillators:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Oscillator | Gen. Radio | 1302A | .5 W | 6 |
| 1 | Oscillator | Eico Elect. | 377 | 60 W | 1 |
| 1 | Oscillator | Arenberg | PG650 | 400 W | 4 |

### C. 2. (b) Other:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Amplifier | McIntosh | M1200 | 200 W | 3 |
| 1 | Sonic Sifter | Allen-Bradley | -- | 95 W | 4 |
| 1 | Exploding Wire Circuit | -- | -- | -- | 3 |

### C. 3. Ultrasonic:

C. 3. (a) Cauterizers: None

### C. 3. (b) Cell and Tissue Disintegrators:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 2 | Disintegrator | Branson Instr. | J17V | 20 KC | 3 |

### C. 3. (c) Cleaners:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 3 | Cleaners | Crest Ultrasonic | 702 | 200 W-20 KHZ | 2 |
| 1 | Cleaner | Phillips | 1025 | 1000 W-25 KHZ | 3 |
| 1 | Cleaner | Crest | 100 | 138 W-1200 W | 2 |
| 1 | Cleaner | Mettler | -- | 1200W-40 KC | 2 |
| 1 | Cleaner | Acoustics Assn. | 520 | 500 W-20 KC | 10 |
| 1 | Cleaner | Ultrasonic | T-320C3 | -- | 2 |
| 1 | Cleaner | Ultrasonic | G80CiP | -- | 2 |
| 1 | Cleaner | McKenna | 100 | 1000 V | 2 |
| 1 | Cleaner | Buehler | 1950 | -- | 1 |
| 1 | Cleaner | Alcar Instr. | SUVD500 | 250 W-40 KHZ | 1 |
| 1 | Cleaner | Branson | A-150 | 150 W-25 KHZ | 4 |
| 1 | Cleaner | Crest | 909 | 1550 W | 4 |

See next page

C. 3. (c) Cleaners (continuation):

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Cleaner | Crest | 701 | 100 W | 1 |
| 1 | Cleaner | Branson | S125 | 125 W | 2 |
| 1 | Cleaner | Ultrasonic | 80 | 120 W-80 KHZ | 8 |
| 1 | Cleaner | L & R Mfg. | 430G | 200 W | 2 |
| 1 | Cleaner | Ultrasonic | G40 | 80 KHZ | 1 |
| 1 | Cleaner | Buehler | 1950 | 100 W | 2 |
| 1 | Cleaner | Ultrasonic | G80 | 120 W-80 KHZ | 3 |
| 1 | Cleaner | Rich Roth Lab. | 400 | 22 HZ | 2 |
| 1 | Cleaner | American Pro. | A3-D | -- | 3 |
| 8 | Cleaners | Ultrasonic | G-4001 | 40 W | 12 |
| 1 | Cleaners | Ultrasonic | DR | 500 W | 1 |
| 1 | Cleaner | Sonogen | AP | 200 W | 2 |
| 1 | Cleaner | Blackstone | CW5 | 500 W-22 KC | 7. |
| 1 | Cleaner | Ultrasonic | G406 | 80 W-80 KC | 10 |
| 1 | Cleaner | McKenna | 100 | 1000 KC | 5 |
| 1 | Cleaner | Bendix | AB2G | 150 W | -- |
| 1 | Cleaner | Buehler | 75-1950 | 184 W-200 W | 4 |
| 1 | Cleaner | Branson | AP-25 | 200 W-350 KC | 10 |
| 1 | Cleaner | Westinghouse | 7505765 | 250 W | 1 |
| 1 | Cleaner | Crest | 707 | 1000 W | 3 |
| 1 | Cleaner | Branson | LG-40 | 50 W | 2 |

C. 3. (d) Diagnostic and Nondestructive Testing Equipment:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Reflectoscope | "Sperry" | 50E401 | 190 W-0.5 to 5.0 MC | 6 |
| 1 | Nondestructive tester | Branson | 2 0 | 300 W-200 KC | 4 |

C. 3. (e) Ranging and Detection Equipment: None

C. 3. (f) Other: See next page.

C. 3. (f) Other:

| No. units | Description | Make | Model | Power | Potential personnel exposure |
|---|---|---|---|---|---|
| 1 | Sonogen D | Branson | 150 | 150 W-40 KC | 5 |
| 1 | Generator | Gulton Ind. | 500 VF | 40 W-400 KC | 2 |
| 1 | Oscillator | Hewlett-Packard | -- | -- | -- |
| 1 | Generator | Blackstone | SS-1 | 200 W | 2 |
| 1 | Tester | Sperry | 50C901 | 1 W-2.5-5.0 MHZ | 4 |
| 1 | Nebulizer | DeVillbiss | 800/882 | 400 W | 4 |

Department of Agriculture - An inventory of radioactive materials and ionizing radiation emitting equipment is provided. Also an indication of types of other radiation sources in use is provided.

(Radiological Safety Office) - The U.S. Department of Agriculture has the following radioactive materials and/or radiation emanating equipment over which the RSC has jurisdiction.

| No. & Kind of Product | Radiation | No. of Personnel Involved | Possibility of General Public Being Exposed |
|---|---|---|---|
| 30 X-ray machines | X-rays | 60 | None |
| 18 Electron Microscopes | Possible X-rays | 36 | None |
| 140 RaBe sources Soil Moisture & Density Gauges | $\gamma$-rays, neutrons (3-5 mc/source) | 350 | None |
| 30 Ra226 Foils in Electron Capture Detectors in Gas Chromatographs | $\beta$ & $\gamma$ (56 or 88 c/foil) | 60 | None |

The Department also possesses irradiators, soil moisture and density gauges, and other devices which contain byproduct materials which are regulated under the Atomic Energy Act of 1954 and under Department licenses, regulations and procedures.

(Consumer and Marketing Service) - In our programs of inspection and grading of meat and poultry, grain, and dairy products, we utilize numerous ultraviolet lamps ("black lights") nationwide. Manufactured by several companies, these are all long-wave ultraviolet lamps for use in detecting foreign substances in food products, and in chromophotography. If a complete list of locations, model numbers, etc., is required we will need considerable time to compile it.

This agency has also purchased a microwave oven for use in our Consumer Protection Program, Labels and Standards Branch.

b. Unknown.
c. Unknown.

(Forest Service) - The Forest Service identifies 158 radiation sources (electronic product or radioactive sources). 461 persons of the agency may be potentially exposed. No persons not under the control of the agency are exposed.

Department of Commerce - Estimates of the number of electronic product radiation sources and radioactive material sources possessed by the National Bureau of Standards, the Environmental Science Services Administration, and the Maritime Administration are given in the following table. Also included are estimates of the number of agency personnel potentially exposed and an indication whether or not the general public may be exposed to radiation from these sources.

Department of Labor - "No."

Department of Housing and Urban Development - "Negative."

Department of Transportation - Four administrations, the U.S. Coast Guard, St. Lawrence Seaway Development Corporation, the Bureau of Public Roads, and the Federal Aviation Administration provided inventory information.

(U.S. Coast Guard) - In reference to the specific sources of radiation contained in Attachment I, those with which the Coast Guard is primarily concerned are the transmitting elements of communications equipment, radar devices and Loran. Additionally, television receivers are numerous and widely dispersed throughout the service. Those sources relating to medical diagnosis or treatment which may be physically located in Coast Guard establishments are under the cognizance of the U.S. Public Health Service.

Generally, the radiation levels of the communication equipment used in the Coast Guard aren't high enough to constitute a serious health hazard.

## National Bureau of Standards

| Product or Source | No. Possessed | No. of Agency Personnel Potentially Exposed | May General Public Be Exposed? |
|---|---|---|---|
| 1. Radioactive materials: | | | |
| Radium | 1 | 0 | No |
| Radon and daughters | 1 | 4 | No |
| Other "natural" radionuclides | 2 | 7 | No |
| | 1 | + | Yes |
| Accelerator-produced radionuclides | 7 | 5 | No |
| Other | 3 | 9 | No |
| 2. Electronic products: | | | |
| X-ray machines | 11 | 51 | No |
| | 1 | 5 | Yes |
| Television receivers | 23 | 53 | No |
| | 2 | 0 | Yes |
| Neutron generators | 1 | 3 | No |
| Accelerators | 6 | 22 | No |
| Klystron tubes | 82 | 50 | No |
| | 235 | 21 | Yes |
| Electron microscopes | 11 | 24 | No |
| X-ray diffraction instruments | 31 | 47 | No |
| Other | 56 | 76 | No |
| | 6 | 5+ | Yes |
| 3. Ultraviolet: | | | |
| Biochemical & Medical analysis | 7 | 10 | No |
| Cosmetic & therapeutic lamps | 4 | 3 | No |
| | 1 | 5 | Yes |
| Sanitizing & sterilizing devices | 5 | 10 | No |
| Other | 116 | 126 | No |
| | 33 | 42+ | Yes |
| 4. Visible: | | | |
| White light devices | 51 | 93 | No |
| Other | 16 | 24 | No |
| | 4 | 4 | Yes |

## National Bureau of Standards (Cont.)

| Product or Source | No. Possessed | No. of Agency Personnel Potentially Exposed | May General Public Be Exposed? |
|---|---|---|---|
| 5. Infrared: | | | |
| Alarm systems | 1 | 3 | No |
| Dryers, ovens, & heaters | 38 | 67 | No |
| | 14 | 4+ | Yes |
| Other | 94 | 104 | No |
| | 10 | 2 | Yes |
| 6. Microwave: | | | |
| Diathermy units | 33 | 52 | No |
| | 3 | 10 | Yes |
| Dryers, ovens, & heaters | 1 | 1 | No |
| | 3 | + | Yes |
| Medica-biological heaters | 1 | 2 | Yes |
| Microwave power generating devices | 25 | 44 | No |
| Radar devices | 2 | 6 | No |
| Signal generators | 34 | 41 | No |
| Other | 6 | 25 | No |
| 7. Radio and low frequency: | | | |
| Diathermy units | 9 | 15 | No |
| | 1 | 5 | Yes |
| Power generation & transmission | 81 | 61 | No |
| | 3 | 18 | Yes |
| Signal generators | 83 | 92 | No |
| | 20 | 33 | Yes |
| Other | 29 | 30 | No |
| 8. Lasers: | | | |
| Art form, experimental, & educational | 35 | 54 | No |
| | 6 | 14 | Yes |
| Range finding devices | 1 | 3 | Yes |
| Other | 26 | 24 | No |
| | 1 | 3 | Yes |
| 9. Masers: | | | |
| Other | 3 | 12 | No |

## National Bureau of Standards (Cont.)

| | Product or Source | No. Possessed | No. of Agency Personnel Potentially Exposed | May General Public Be Exposed? |
|---|---|---|---|---|
| 10. | Infrasonic: | | | |
| | Vibrators | 2 | 1 | No |
| | | 5 | 32 | Yes |
| | Other | 2 | 32 | Yes |
| 11. | Sonic: | | | |
| | Electronic oscillators | 27 | 60 | No |
| | | 28 | 19 | Yes |
| | Other | 6 | 17 | No |
| | | 22 | 8+ | Yes |
| 12. | Ultrasonic: | | | |
| | Cleaners | 62 | 208 | No |
| | Diagnostic & nondestructive testing | 1 | 2 | No |
| | | 2 | 8+ | Yes |
| | Ranging & detection equipment | 2 | 3 | No |
| | Other | 4 | 13 | No |
| | | 11 | 8 | Yes |

## Environmental Science Services Administration

| Product or Source | No. Possessed | No. of Agency Personnel Potentially Exposed | May General Public Be Exposed? |
|---|---|---|---|
| 1. Radioactive materials: | | | |
| Radium | 200 | 10 | No |
| Other (depth moisture gauge) | 7 | 15 | Yes |
| 2. Electronic products: | | | |
| Television receivers | 3+ | 30+ | |
| Klystron tubes | Yes | | |
| 3. Ultraviolet: | | | |
| Other (various lamps) | 12+ | 4 | No |
| 4. Infrared: | | | |
| Dryers, ovens, & heaters | Yes | | |
| 5. Microwave: | | | |
| Radar devices | 177+ | 220 | Yes |
| 6. Radio and low frequency: | | | |
| Power generation & transmission | 111+ | 70 | |
| Signal generators | Yes | | |
| 7. Lasers: | | | |
| Range finding devices | 13+ | 30 | No |
| Other | 2 | 20 | No |
| 8. Ultrasonic: | | | |
| Cleaners | Yes | | |
| Ranging & detection equipment | Yes | | No |

## Maritime Administration

| Product or Source | No. Possessed | No. of Agency Personnel Potentially Exposed | May General Public Be Exposed? |
|---|---|---|---|
| 1. Electronic products: | | | |
| Neutron generators | 2 | 2 | No |
| 2. Ultraviolet: | | | |
| Other (lamp) | 3 | 2 | No |
| 3. Visible: | | | |
| Other (arcwelders) | Several | Numerous | Unknown |
| 4. Infrared: | | | |
| Dryers, ovens, & heaters | 1 | 3 | No |
| 5. Microwave: | | | |
| Radar devices | 2 | 3 | No |
| 6. Radio and low frequency: | | | |
| Signal generators | Unknown | Unknown | No |
| Other (electric generators) | 7 | Several | No |
| 7. Ultrasonic: | | | |
| Cleaners | 2 | 4 | No |

Many types of electron tubes in use by the Coast Guard contain radioactive material. A list of these tubes, along with the precautions to be observed in their stowage and handling are contained in the Coast Guard Electronics Maintenance Manual (CG-165). See Enclosure (1).

Distributed throughout the Coast Guard are approximately 11,000 transmitters and transceivers designed to operate in the radio frequency (RF) range. These vary from one-watt hand held units to three-million-watt peak power loran transmitters. Also in use are several hundred RF signal generators. These are low power devices used for calibration, testing and maintenance. Information regarding RF radiation hazards is included in CG-165. See Enclosure (2).

The Coast Guard has approximately 700 radar systems operating in the microwave range. These cover a range in peak power rating of from three thousand to 750 thousand watts. Further, we have several hundred pieces of low power microwave test equipment and approximately two hundred IFF transponders (microwave transmitters). Radiation safety precautions are contained in CG-165. See Enclosure (2).

On board Coast Guard vessels are about 70 low power infra-red transmitters used for communications purposes. No special health hazard control procedures, regulations or guidelines have been established to cover these items.

No regulation standards or control procedures have been promulgated covering the several hundred commercial model television receivers, pertaining to X-ray radiation, found widely distributed through Coast Guard establishments. However, industry standards would apply to this equipment. Recent ship building specifications for those vessels now under construction require the contractor to furnish color TV sets having an X-ray radiation level of less than 0.5 milliroentgens per hour.

Regulations covering the handling, transport and stowage of natural radiating material not controlled by AEC requirements are found in 46 CFR 146.

(Saint Lawrence Seaway Development Corporation) -

7. Yes
    a. 2 Fixed Medium Frequency Transmitters-Output 150 watts each
       2 Fixed Very High Frequency Transmitters-Output 80 watts each
       10 Mobile Very High Frequency Transmitters-Output 30 watts each
    b. 100 Personnel (approximately)
    c. Yes, to a certain extent.

## Bureau of Public Roads

| | | Estimated Number of Products | | | | Estimated No. of Personnel Potentially Exposed | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Electronic Product | Agency | State | Test Lab | Con-tractor | Agency | State | Test Lab | Con-tractor |
| A.2.(a) | X-ray machines | 0 | 0 | 30 | 25 | 0 | 0 | 100 | 50 |
| (b) | Television receivers for traffic monitor | 0 | 30 | 0 | 0 | 0 | 50 | 0 | 0 |
| (c) | Neutron generators for density tests | 10 | 567 | 0 | 0 | 40 | 700 | 0 | 0 |
| (g) | X-ray diffraction | 1 | 20 | 0 | 0 | 3 | 40 | 0 | 0 |
| B.1.(d) | Spectrophotometer | 1 | 3 | 0 | 0 | 30 | 60 | 0 | 0 |
| B.3.(b) | Infrared dryers | 12 | 85 | 0 | 0 | 70 | 200 | 0 | 0 |
| (c) | Infrared photography | 0 | 6 | 0 | 0 | 0 | 12 | 0 | 0 |
| | Spectrophotometer | 1 | 20 | 0 | 0 | 3 | 40 | 0 | 0 |
| B.4.(c) | Microwave ovens | 0 | 3 | 0 | 0 | 0 | 6 | 0 | 0 |
| (f) | Microwave radar devices | 12 | 160 | 0 | 0 | 25 | 320 | 0 | 0 |
| C.1.(a) | Vibrators | 0 | 5 | 0 | 0 | 0 | 15 | 0 | 0 |
| C.2.(b) | Concrete flaw detector | 1 | 0 | 0 | 0 | 5 | 0 | 0 | 0 |
| C.3.(d) | Diagnostic and nondestructive testing equipment | 3 | 15 | 5 | 10 | 30 | 75 | 100 | 200 |

---

NOTE: There is no potential exposure of the public.

(Federal Aviation Administration) - There are about 1000 medium power klystrons (type SAL 89) used in TACAN and VORTAL stations and nearly 70 high power klystrons operating at radar installations. Each tube is enclosed in lead.

The FAA operates radar and other types of microwave-disseminating communications equipment on a worldwide basis. Microwave producing devices of sufficient power to warrant protective consideration and treatment number about 250 at 121 terminal radars.

The FAA maintains low frequency ranges and high frequency overseas transmission stations which produce both radio and low frequency emissions. All of these units are located in isolated areas and protected by fences. There are approximately 350 medium and high power transmitters other than microwave at 84 long range radar facilities and other facilities.

The agency operates no lasers or masers and only several small sonic cleaners which are adequately protected.

Department of Health, Education, and Welfare - Yes, the following 11 agencies use or possess radiation sources:

1. Bureau of Community Environmental Management (BCEM)
2. Food and Drug Administration (FDA)
3. National Institutes of Health (NIH)
4. Bureau of Solid Waste Management (BSWM)
5. Social Security Administration (SSA)
6. Office of Education (CE)
7. National Air Pollution Control Administration (NAPCA)
8. Health Services and Mental Health Administration (HSMHA)
9. Bureau of Occupational Safety and Health (BOSH)
10. Bureau of Water Hygiene (BWH)
11. Bureau of Radiological Health (BRH)

Table I summarizes the inventory of electronic products, by agency, for the major categories of radiation. Some agencies reported ranges of numbers while others used descriptive terms for reporting certain categories.

Table II indicates the distribution by agency and type of electronic product for ionizing radiation.

Table III reports, by agency, the inventory of radium sources and devices by units and total activity.

# Table I
## Summary of Inventory of Electronic Products

| AGENCY | A.2. | B.1. | B.2. | B.3. | B.4. | B.5. | B.6.A. | B.6.B. | C.1. | C.2. | C.3. | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Radiation Producing Devices | Ultraviolet | Visible | Infrared | Microwave | Radio & Low Frequency | Lasers | Masers | Infrasonic | Sonic | Ultrasonic | |
| SRS | | | | | | | | | | | | 0 |
| OE | 6 | | | | | | | | | | | 6 |
| BSWM | | 5 | | 1 | | 1 | 1 | | | | | 8 |
| BWH | | 59 | | | | | | | | | 7 | 66 |
| BRH | 46 | 35 | 4 | 20 | 59 | 54 | 7 | | 1 | 27 | 8 | 261 |
| BOSH | 2 | 3 | | 1 | | 1 | 1 | | | *many | 6 | 14 |
| BCEM | | 66 | | 65 | | 10 | | | | | 3 | 144 |
| NIH | 489 | 813-<br>1014+<br>(913) | 12 | >900 | 13 | 177 | 4 | | | 130 | 84+ | 2622-<br>2823<br>(2722) |
| HSMHS | 1057+ | 642 | 1114 | 73 | 51 | 158 | 21 | | 1 | 4 | 131 | 3252 |
| FDA | 83 | 559 | 23 | 60 | 14 | 10 | 1 | | | 15 | 38 | 803 |
| NAPCA | 17 | 1440 | 8 | 12 | | 4 | | | | | 7 | 1488 |
| SSA | 2 | | | | 4 | 1 | | | | | 2 | 9 |
| TOTALS | 1702 | 3722 | 1161 | 1132 | 141 | 416 | 35 | 0 | 2 | 176 | 286 | 8773 |

## Table II

### Summary of Inventory of Ionizing Electromagnetic Radiation Electronic Products

| Radiation Producing Devices | SRS | OE | BSWM | BWH | BRH | BOSH | BCEM | NIH | FDA | HSMHA | NAPCA | SSA | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Medical Diagnostic X-ray Machines | | | | | 10 | | | 45 | 2 | 252+ | 1 | 2 | 312 |
| Dental X-ray Machines (Therapeutic) | | | | | 7 | | | 22 | | 166 | | | 195 |
| Therapeutic X-ray Machines | | | | | 5 | | | 6 | | 6 | | | 17 |
| Veterinary X-ray Machines | | | | | | | | 5 | 1 | 3 | | | 9 |
| Research X-ray Machines | | | | | 7 | | | 3 | 15 | 3 | 1 | | 29 |
| Particle Accelerator (Linacs, Betatrons, Cyclotrons, Neutron Generator) | | | | | 2 | | | 3 | | | | | 5 |
| Analytical X-ray Equipment (Diffraction & Spectrographic Units) | | | | | 1 | 2 | | 16 | 10 | | | | 29 |
| Conventional Industrial X-ray Machines | | | | | 1 | | | 1 | | | | | 2 |
| Electron Microscopes & Microprobes | | | | | 2 | | | 56 | 2 | 9 | | | 69 |
| Television Receivers | | 6 | | | 4 | | | 331 | 21 | 609 | 6 | | 977 |
| Klystron Tubes | | | | | 4 | | | 1 | | 3 | | | 8 |
| Electron Beam Welders | | | | | 3 | | | | | | | | 3 |
| Other (Specify) | | | | | | | | | 32 | 6 | 9 | | 47 |
| Totals | 0 | 6 | 0 | 0 | 46 | 2 | 0 | 489 | 83 | 1057 | 17 | 2 | 1702 |

## Table III

## Inventory of Radium Sources and Devices

| Agency | A.1. Radium Sources and Devices | No. Units | Total Activity in mg. |
|---|---|---|---|
| SRS | None | | |
| OE | None | | |
| BSWM | None | | |
| BWH | None | | |
| BOSH | None | | |
| BCEM | None | | |
| SSA | None | | |
| BRH | Medical Sources<br>Ra-Be Sources | 407<br>22 | 3078<br>5606 |
| NIH | Medical Sources | 1501 | 8358 |
| NAPCA | Counter with External Radium Sources | 1 | 1 |
| FDA | Gas Chromatograph Ionization Detectors Radium 226 | 28 | .056 MC per detector |
| HSMHA | Medical Sources | 1397 | 8098.062 |

United States Atomic Energy Commission - The AEC and its contractors use most of the electronic products or radioactive materials listed in Attachment I.

a) The following inventory applies to the approximate number of operating accelerators and quantity of radium in the AEC program:

| | |
|---|---|
| Accelerators | - 210 |
| Radium | - approx. 10 grams |

We are attempting to obtain the balance of the inventory from our contractors for the items listed in your Attachment I. However, in view of your inability to provide a better classification relating the items to safety, we are not hopeful that the information when received would be of much use to your study. I am sure that you appreciate the fact that there are electronic products which fall in the general categories in Attachment I, but yet present no safety problems. Thus, our estimate should be construed as a rough approximation for the purposes of your study.

b) The information is currently being obtained from our contractors.

c) We have no record of any exposure to the general public from the use of materials and products noted in Attachment I.

Agency for International Development - This agency provides equipment of many kinds to less developed countries and the equipment is operated, in nearly all cases, by country employees. Only in rare cases is this equipment used, or it's use supervised, by A.I.D. or it's contractor personnel. Types of equipment that might produce harmful radiation are not listed separately in A.I.D.'s equipment listing and, unless these types of equipment are listed separately in the future, there is no way that such an estimate as requested can be arrived at.

Civil Aeronautics Board - Generally, not applicable. The only electronic equipment possessed by the Board are automatic data processing components. The Board's ADP equipment configuration includes no cathode ray tubes or television devices which emit the types of radiation indicated in Attachment 1 of Dr. Augustine's covering letter. The only device of this type within the possession of the Board of which we are aware is a small oscilloscope used by the equipment supplier (IBM) for testing equipment components.

District of Columbia Government - Members of the public are routinely exposed to x-ray equipment and radioactive material used by health clinics and hospitals under the administration of the agency. The extent of exposure to sources of non-ionizing radiation through the agency or its contractors is not known.

## D.C. GOVERNMENT's SOURCES OF IONIZING RADIATION

| D.C. Gov't. Radiation Sources | Medical X-ray | | Dental X-ray | Other Radiation Machines | Isotope Installations | Radiation Workers |
|---|---|---|---|---|---|---|
| Owned by: | Machines | Tubes | | | | |
| Dept. of Public Health | 49 | 59 | 30 | - | 6 | 218 |
| Dept. of Corrections | 7 | 13 | 4 | - | - | 7 |
| Dept. of Welfare | 4 | 5 | 3 | - | - | 12 |
| Office of Civil Defense | - | - | - | - | 4 | 10 |
| Fire Dept. | - | - | - | - | 1 | 1 |
| Office of Coroner | 1 | 1 | - | - | 1 | 2 |
| Board of Education | 2 | 3 | 1 | 14 | 2 | 8 |
| TOTAL | 63 | 81 | 38 | 14 | 14 | 258 |

Federal Communications Commission - The following table lists the approximate quantities owned and in use in the Commission of "electronic products or radioactive sources" listed in your Attachment I, together with the number of agency personnel who potentially may be exposed to radiation from each type of device in connection with their assigned duties; the bulk of these items are used in our field and laboratory organizations:

| | Item | No. of Devices | No. of Persons |
|---|---|---|---|
| A2(b) | Television receivers | 90 | 220 |
| A2(e) | Klystron tubes (low power) | 30 | 60 |
| B4(b) | Microwave diathermy | 1 | 2 |
| B4(h) | Microwave Signal Generator, less than 10 milliwatts | 12 | 60 |
| B5(c) | HF and VHF transmitters (except hand carried low power units) | 120 | 200 |
| B5(c) | Signal Generator, less than 10 milliwatts | 120 | 220 |
| | Signal Generator, over 10 milliwatts and up to 10 watts | 3 | 10 |
| | Signal Generator, over 10 watts | 1 | 5 |
| C1(a) | Infrasonic vibrators | 1 | 5 |
| C2(a) | Sonic oscillators (Various loud-speaker systems used in receiver and intercom systems) | many | many |
| C3(f) | Ultrasonic vaporizer | 1 | 5 |

Exposure of our field employees to strong rf fields would in most cases be expected to be of short duration such as during the progress of a station inspection, maintenance and tube-up of our communications transmitters, and investigation of industrial facilities using rf devices. All of our monitoring stations have HF transmitting equipment varying in power from a few hundred watts to as much as 10 kW. With a few exceptions all of the transmitters with 1 kW or more rated rf output are installed at a considerable distance from the monitoring building, primarily to minimize interference to monitoring operations while the transmitters are being keyed. Special precautions are taken in the establishment and operation of a monitoring station to keep to a minimum radiation from rf power generators, from radio transmitters operated by other Government agencies and by Commission licensees as well as from rf power generating devices which must be operated in conjunction with the monitoring station activities. Since our transmitters normally operate unattended, we would expect much less likelihood of injury to personnel from extended exposure of rf energy than would be the case, for example, in a high power broadcase station where maintenance and operating personnel may be in strong rf fields for part or all of the working day and extending over many years.

Our Laboratory continuously receives and tests single units of the following types of equipments:

> Television receivers, microwave diathermy units, microwave ovens, radars, remote control devices, microwave signal generators, radio frequency diathermy units, power generators and transmitters, industrial heaters, rf signal generators, lasers excited by rf, ultrasonic medical devices, ultrasonic cleaners, ultrasonic diagnostic and testing equipment, ultrasonic drilling, homogenizing, nebulizing and mixing equipment, and so on. In most of these cases the one or two test personnel remain close to the device for hours or days. However, their distance is usually not closer than that normally expected in regular use of each device.

The general public is not exposed in the course of the Commission's own operations and tests, or in the activities of its contractors.

General Accounting Office - We have completed a listing of all equipment in our agency that could possibly emit harmful radiation. We did this partly because we are a relatively small agency and thus able to do it, and partly because your staff member who visited us indicated some diaagreement even among professional persons expert in the field, as to what constitute potential hazards. Thus, we decided to include all possibilities. As a small agency with no scientific, medical, or similar functions, we understandably have nothing that would emit radiation other than routine office equipment and audio-visual equipment. (Complete inventory is available in the Bureau of Radiological Health.)

Interstate Commerce Commission - No, except as indicated. The Commission operates no equipment from which ionizing electromagnetic and particulate radiation may be emitted. However, the Commission has two types of electronic products which should be mentioned: (1) a color television set in its conference room and (2) two oscillioscopes which are owned and used by RCA in maintenance and repair operations to our RCA Spectra 70 computer.

The Commission operates no cosmetic or therapeutic lamps as contained in item B1 of Attachment I, but the nurse does have an infrared bulb in our health unit. On rare occasions this might be utilized for heat treatment of employees.

With respect to Item B2, the only lighting devices operated are the standard fluorescent light fixtures in the ceiling of the rooms in our building and certain smaller fluorescent desk lamps. In addition, there are several standard so-called "high intensity" lamps mounted on the bench in our hearing room "B".

With respect to Item B3, the Commission's snackbar is equipped with so-called fast heating ovens, which are infrared systems. Also, there are infrared lamps on the steam tables in the cafeteria. Our fire alarm system in the building is actuated manually, or automatically by means of heat sensitivity devices.

The Commission operates no radio and low frequency radiation inducing devices referred to in Item B5. However, we do operate some GSA automobiles which are equipped with radio-telephone devices. Whether they are signal generators of appropriate style or sufficient power to qualify for inclusion in your study is not known by the Commission.

Except as to the extent outlined above, the Commission has no equipment known or suspected to emit electronic product radiation.

Library of Congress - None.

National Aeronautics and Space Administration - The following NASA operations provided inventory and exposure estimates:

1. Ames Research Center
2. Electronics Research Center
3. Flight Research Center
4. Lewis Research Center
5. Langley Research Center
6. Jet Propulsion Laboratory
7. Kennedy Space Center
8. Mississippi Test Facility
9. Marshall Space Flight Center
10. Michoud Assembly Facility
11. Goddard Space Flight Center
12. Manned Spacecraft Center

(Ames Research Center) - Enclosure U is a copy of the inventory of the X-ray machines at this laboratory. This listing gives the Radiation Safety Committee a complete description of the instrument, its location, and who is responsible for its operation. A similar inventory listing has been requested for the other electronic products; for example: electron microscopes, electron beam welding machines, etc. This documentation will be available soon. There are less than ten items in this category. All personnel who operate or maintain this type of equipment are given film badges. There are approximately 500 film badges processed monthly. Areas where this type of equipment is operated are well controlled with extensive use of safeguards; for example: interlocks on gates or doors to exclude unauthorized persons. Visitors who must enter these areas are provided radiation film badges or pocket dosimeters during their visit.

(Electronics Research Center) - This Center does have radiation emitting devices and the following approximate numbers are present:

a. Forty-five pieces of various types of lasers, four X-ray diffraction units, one X-ray inspection unit, four low power microwave units, one electron microprobe, one scanning electron microscope, two X-ray fluorescent spectrometers, two color television receivers, and two ultraviolet lamps.
   X-ray equipment is either completely enclosed or well shielded. Microwave generators are either completely enclosed or of low power levels. Laboratory supervisors are aware of potential radiation hazards and have taken means to control them.
   The use of radioactive materials is negligible.
b. Seventy research employees are exposed to laser radiation and fifty to other forms of radiation.
c. Members of the general public would not be exposed to radiation unless they were guilty of trespassing into areas under control of the government.

Members of the general public are not exposed to radiation or to radioactive materials either licensed or unlicensed in excess of the limits specified by AEC regulations at the Plum Brook Reactor Facility.

(Flight Research Center) -

| | | | |
|---|---|---|---|
| a.1. | Radioisotope test sources | 20 | secured |
| 2. | F-104 oil gage isotope sources | 10 | installed |
| 3. | Aircraft counterweights | -- | installed |
| 4. | X-ray machine | 1 | surveyed |
| 5. | Lasers: gas | 1 | controlled |
| | diode | 1 | controlled |

b.

| Source Above | Number of Personnel |
|---|---|
| 1 | 2 |
| 2 | 18 |
| 3 | 2 |
| 4 | 4 |
| 5 | 2 |

c. General public cannot be exposed to any of the above.

(Lewis Research Center) - Lewis and its contractors use electronic devices and radioactive materials in pursuit of research and development objectives. Below are listed some sources at LeRC:

| Type Source | Number Sources | Number Personnel |
|---|---|---|
| Alphatron Gauges (Radium source) | 10 | 3 |
| X-ray diffraction unit | 12 | 24 |
| X-ray machines | 5 | 5 |
| Neutron generators | 2 | 4 |

Members of the general public cannot be exposed to radiation from these sources.

Our report pertains to operations conducted at the Cleveland, Ohio location of the Center. Information on items such as diathermy units, lasers, electron microscopes, and ultrasonic cleaners is not included.

(Langley Research Center) - NASA Langley Research Center uses and possesses electronic products.

A. Ionizing electromagnetic and particulate radiation from the following:
   1. Radioactive material - a number of very low (microcurie) radium calibration sources
   2. Electronic products
      a. X-ray - 6 units (300 KV maximum)
      b. Television receivers - 96 units - 20 KV
         8 units - 40 KV
         3 units - 80 KV
      c. Neutron generator - 1 unit
      d. Accelerators - 8 units ($e^-$ - 0.1 to 12 MeV)
         ($p^+$ - 0.1 to 600 MeV)
      e. Klystron tube - 1 each (used with linear accelerator)
      f. Electron microscopes - 6 each
      g. X-ray diffraction instruments - 6 units
      h. Electron beam welders - 1 unit
      i. (other) Vacuum deposition systems - electron gun type - 2 units

B. Non-ionizing electromagnetic radiation
   1. Ultraviolet
      a. None
      b. None
      c. None
      d. (Other) spectrometers - 6 units, solar simulators - 10 units
   2. Visible - Yes, but no inventory kept for safety purposes.
   3. Infrared
      a. Alarm systems - none
      b. Dryers, ovens, and heaters - Yes, no inventory kept for safety purposes
      c. Spectrometers - 29 units

4. Microwave
    a. None used
    b. None used
    c. None used
    d. None used
    e. None used
    f. Radar - 5 units
    g. None used
    h. None used
    i. None used
5. Radio and low frequency (only low power units used - no hazard).
6. Coherent electromagnetic radiation
    a. Lasers - 50 units (used primarily for research (CW and pulsed))
    b. Masers - None

C. Infrasonic, sonic and ultrasonic vibration

Various noise research facilities are used in research, many ultrasonic pieces are used, but no inventory is kept for safety purposes.

(Jet Propulsion Laboratory) -

A. Ionizing electromagnetic and particulate radiation from the following:
  1. Radioactive materials not covered by licensing, not applicable.
  2. Electronic products
    a. 4 X-ray machines
    b. 250 television receivers
    c. 1 neutron generator
    d. 1 accelerator
    e. 100 klystron tubes
    f. 3 electron microscopes
    g. 7 X-ray diffraction instruments
    h. 1 electron beam welder

B. Non-ionizing electromagnetic radiation, such as the following:
  1. Ultraviolet, from:
    c. 10 sterilizing devices
    d. 250 2KW ultraviolet lamps for simulating the sun in space.
  3. Infrared, from:
    b. 1000 heat lamps
  4. Microwave, from:
    b. 5 diathermy units
    c. 1 oven
    e. 12 high power (10KW or higher) CW microwave transmitters
    h. 500 signal generators

5. Radio and low frequency, from:
    b. 1 diathermy unit
    c. 6 transmitters
    d. 2000 signal generators
6. Coherent electromagnetic radiation
    a. 25 lasers
    b. masers
        2. 15 in receivers

C. Infrasonic, sonic, and ultrasonic vibrations, resulting from operation of an electronic circuit, such as:
    1. Infrasonic, from:
        a. 2 environmental shake tables
    2. Sonic, from:
        a. 2 environmental shake tables
    3. Ultrasonic, from:
        c. 50 ultrasonic cleaners
        e. 8 motion detectors

500 persons would be potentially exposed to radiation of all types.

It is not likely that the general public would be exposed.

(Kennedy Space Center) -

1. Radium
    A. (8) Toxic Vapor Detectors containing 150 micrograms each
    B. (5) Alphatron Vacuum Gauges containing 100 micrograms each
2. Tritium
    A. (1) Anti Static Device containing 0.2 curies
        (2) Sweeney Probes containing 0.2 curies each
        (3) Chromatographs containing 0.25 curies each
3. X-Ray Machines
    A. Diagnostic
        1. Picker 120 KV (1)
        2. General Electric 150 KV (1)
    B. Industrial
        1. Picker 250 KV (1)
        2. Norelco 100 CP (1)
        3. General Electric 90 KV (1)
        4. General Electric 40 KV (1)
        5. Sperry 140 KV (1)
        6. Norelco PG 140 200 KV (1)
        7. Norelco PG 200 200 KV (1)
        8. General Electric 50 KV (1)
        9. General Electric 100 KV (1)
    C. (2) Diffraction Units - Phillips Electronics Type 1221510
    D. (1) Phillips Electronics Spectrometer

4. Electron Microscopes
   A. (2) Electron EMX - Applied Research Lab
   B. (1) Scanning Mark 2A - Cambridge Engis.
5. Ultraviolet
   A. (2) Magnaflux Units
   B. (1) Black Ray Model UUL22
   C. (4) Black Ray Model MB-100-A
6. Infrared
   A. (2) Spectrophotometers - Beckman DK2
   B. (1) Lamp Spectron Corp Model PTH 220W
   C. (5) Analyzer Model 200 MSA
   D. (1) Analyzer Model 6800 Beckman
   E. (1) Heat Lamp - Norelco Model 2A
7. Microwave
   A. (2) Diathermy Units - Butcher Band Master
   B. Ovens
      1. (18) Litton Industries
      2. (14) Raytheon
      3. (1) M&K Industries Model MK-24
8. Cauterizers
   A. (1) Hyfercator - Bircher Corp. Model
9. Infrasonic
   A. (1) Model MB C-10
   B. (1) C-50 Vibrator System
10. Ultrasonic
   A. (19) Cleaners - Various manufacturers and models
   B. (1) Treatment Unit (Medical)
   C. Flaw Detectors
      1. (1) Mocel USK5M
      2. (2) Bransor Sonoway Model 50

(Mississippi Test Facility) - The support contractor model service operation uses two types of radiation mentioned in Attachment I of subject memorandum, which are x-ray machine (item A2(a)) and diathermy units (item B4b).

The responses as received from the two principal users are attached.

The General Electric Company, MTFO uses the following equipment:
X-Ray Machines - Andreas Model 2021, 200 KV Capacity
Phillips Electronic, 140 KV Capacity
Chromatograph with Tritium Detectors - Varian Aerograph Model No. 02-390
Ultraviolet Spectrophotometer - Beckman Model DBG
Ultraviolet Lamps (Black Light) - Used in Component Cleaning & Inspection
Ultrasonic Cleaner (Vibrator Type) - Mettler Electronic

Infrared Spectrophotometer - IR9, Beckman
Infrared Spectrophotometer - 137B, Perkin-Elmer
Twelve people (five work mostly with x-ray) may be exposed.
General public does not come in contact with any of this equipment.

The North American Rockwell Corporation uses one x-ray unit approximately four times a year. The estimated number of personnel potentially exposed to x-ray activity is 30.

(Marshall Space Flight Center) -

A-1 a. Estimated number of items - 159
b. Estimated number of personnel exposed - 50
c. Are members of the general public exposed - No

A-2 a. Estimated number of items - 46
b. Estimated number of personnel exposed - 100
c. Are members of the general public exposed - No

B-1 a. Estimated number of items - Unknown
b. Estimated number of personnel exposed - Unknown
c. Are members of the general public exposed - No

B-2 a. Estimated number of items - Unknown
b. Estimated number of personnel exposed - Unknown
c. Are members of the general public exposed - No

B-3 a. Estimated number of items - Unknown
b. Estimated number of personnel exposed - Unknown
c. Are members of the general public exposed - No

B-4 a. Estimated number of items - 25
b. Estimated number of personnel exposed - 200
c. Are members of the general public exposed - No

B-5 a. Estimated number of items - Unknown
b. Estimated number of personnel exposed - Unknown
c. Are members of the general public exposed - No

B-6 a. Estimated number of items - 30
b. Estimated number of personnel exposed - 33
c. Are members of the general public exposed - No

C-1 a. Estimated number of items - 40
b. Estimated number of personnel exposed - 30
c. Are members of the general public exposed - No

C-2 a. Estimated number of items - Unknown
b. Estimated number of personnel exposed - Unknown
c. Are members of the general public exposed - No

C-3 a. Estimated number of items - 50
b. Estimated number of personnel exposed - 20
c. Are members of the general public exposed - No

(Michoud Assembly Facility) -

Boeing: The following is a list of possible sources of radiation under Boing control at Michoud:

a. Alphatron gauges (radium) - 2 each
b. Smoke detectors (radium) - 9 each
c. Alnor Dew Point Indicators (radium) - 3 each
d. MSA Billionaire Sampler (radium) - 1 each
e. Beta Sources for the Twin - 6 each
f. City Metal Thickness Gaugs - 6 each
g. X-ray machines - 17 each
h. Klystron Tubes - 5 each
i. Ultraviolet Light Lamps - 18 each
j. Microwave Signal Generator - 6 each
k. Ultrasonic Cleaners - 7 each

Estimated number of people who may be exposed to the equipment:

a. Alphatron gauges - 12
b. Smoke detectors - 3
c. Alnor Dew Point Indicator - 9
d. MSA Billionaire Sampler - 15
e. Beta Sources - 10
f. X-ray machines - 17
g. Klystron Tubes - 6
h. Ultraviolet Light Lamps - 12
i. Microwave Signal Generator - 6
j. Ultrasonic Cleaners - 0

The control procedures apply to anyone within the area of a radioactive source. However, manufacturers' service representatives may expose themselves to electronic gear such as tubes or generators which may produce incidental radiation. These people normally take the protective covers away from the equipment during maintenance, and, consequently, this increases the amount of radiation emitted by the instrument. These instances are rare at Michoud. Wherever significant amounts of incidental radioactivity are suspected, surveys are initiated for evaluation of that area.

Chrysler: Included as CCSD's enclosures E-1, E-2, and E-3, are listings of electronic products and the names of personnel who may be exposed to radiation from these products. No members of the general public or persons not under the control of the MAF installation are susceptible to exposure to any radioactive source.

Mason-Rust:

a. One X-ray machine, diathermy unit, therapeutic lamp, and television receiver.
b. Only the personnel utilizing the equipment.
c. None.

(Goddard Space Flight Center) - The following tables list sources of radiation by type and quantity, and the number of GSFC employees potentially exposed to their radiation. There is no record to show, nor reason to believe, that any exposure to the general public, in excess of the appropriate standard or guideline, has ever occurred due to GSFC Operations.

IONIZING RADIATION

| Source | Quantity | Personnel |
|---|---|---|
| Radionuclides | | |
| Radium (1 - level-sensing device 40 - pressure-sensing devices) | 20 mCi | 80 |
| Natural (other than radium) | 0.1 mCi | 5 |
| Accelerator-produced | 1 mCi | 10 |
| Others | 0.1 mCi | 10 |
| Electronic Products | | |
| X-ray machines | 20 units | 100 |
| Diffraction (50-75 kVP) | 13 | |
| Radiography (110-250 kVP) | 6 | |
| Medical (100 kVP) | 1 | |
| Television Receivers | 300 sets | 100 |
| Neutron Generators | 2 units | 5 |
| Texas Nuclear | (0.3 MeV, 1 each) | |
| Moisture probe | (1 each) | |
| Accelerators | | 10 |
| 2 MeV Van de Graaff | (3 each) | |
| 4 MeV Dynamatron | (1 each) | |
| 0.25 MeV Van de Craaff | (1 each) | |
| Klystron Tubes | (500 W - 3 MW, 40 each) | 450 |
| Electron Microscopes | (20 - 100 kVP, 7 each) | 10 |
| Electron Beam Welder | (25 kVP, 1 each) | 15 |
| Spark Chamber | (19 kVP, 1 each) | 3 |
| High Voltage Tubes | | 10 |

## NON-IONIZING RADIATION

| Source | Quantity | Personnel |
|---|---|---|
| Ultraviolet | | |
| Solar Simulators | 80 lamps | 80 |
| White Light | | |
| Solar Simulators | 200 lamps | 80 |
| Infrared | | |
| Dryers and Ovens | 60 units | 30 |
| Microwave | | |
| Diathermy | (4 each) | 24 |
| Ovens | (1 kW, 8 each) | 700* |
| *Approximately 700 exposures per day. 45 seconds per exposure. | | |
| Radar Transmitters | (22 each) | 2600 |
| Command Transmitters | (31 each) | |
| Communications Transmitters | (5 each) | |
| Radio and Low Frequency | | |
| Induction Furnaces | ( 45 kVA, 8 each) | 35 |
| RF Ion Source | (30 kV, 1 each) | 5 |
| Stimulated Emission Devices | | |
| Lasers** | 69 | 106 |
| (Argon, 7 each) | | |
| (He-Ne, 43 each) | | |
| (Ruby, 6 each) | | |
| ($CO_2$, 11 each) | | |
| (Injection diode, 2 each) | | |
| Masers (Communications) | 2 | 40 |

**Because the bulk of GSFC laser effort is experimental it is more meaningful to list the lasers by type rather than intended use.

## ACOUSTIC WAVE DEVICES

| Source | Quantity | Personnel |
|---|---|---|
| Infrasonic Vibrators | 10 each | 30 |
| Sonic Vibrators | 12 each | 36 |
| Ultrasonic Cleaners | 46 each | 140 |

(Manned Spacecraft Center) - The following is a rough estimate of radioactive materials and electronic products that emit ionizing and non-ionizing radiation at MSC and the number of MSC and contractor personnel potentially exposed. Exposure to the general public is considered non-existent because of the restriction of tourists in the use areas.

| Type | Estimated Number | Estimated No. of Exposed Personnel |
|---|---|---|
| Ionizing radiation from radioactive materials other than those regulated by AEC | | |
| a. radium | 71 | 200 |
| b. radon and daughters | 10 | 50 |
| c. other "natural" radionuclides | 6 | 25 |
| d. accelerator produced radionuclides | 0 | 0 |
| Ionizing radiation from electronic products | | |
| a. X-ray machines | 12 | 50 |
| b. television receivers | 100 | 1000 |
| c. neutron generators | 3 | 25 |
| d. accelerators | 2 | 25 |
| e. klystron tubes | 5 | 100 |
| f. electron microscopes | 2 | 25 |
| g. X-ray diffraction instruments | 7 | 150 |
| h. electron beam welders | 1 | 25 |
| i. other | 12 | 150 |
| Ultraviolet | | |
| a. biochemical & medical analyzers | 10 | 15 |
| b. cosmetic & therapeutic lamps | 3 | 10 |
| c. sanitizing & sterilizing devices | 150 | 300 |
| Visible | | |
| a. white light device | 75 | 500 |
| Infrared | | |
| a. alarm systems | 0 | 0 |
| b. dryers, ovens & heaters | 10 | 75 |

| Type | Estimated Number | Estimated No. of Exposed Personnel |
|---|---|---|
| Microwave | | |
| a. alarm systems | 0 | 0 |
| b. diathermy units | 0 | 0 |
| c. dryers, ovens & heaters | 7 | 2000 |
| d. medico-biological heaters | 0 | 0 |
| e. microwave power generating devices | 0 | 0 |
| f. radar devices | 5 | 100 |
| g. remote control devices | 0 | 0 |
| h. signal generators | 0 | 0 |
| Radio and low frequency | | |
| a. cauterizers | 0 | 0 |
| b. diathermy units | 0 | 0 |
| c. power generation & transmission equipment | 5 | 100 |
| d. signal generators | 10 | 150 |
| Coherent electromagnetic radiation produced by stimulated emission | | |
| a. lasers | 15 | 100 |
| b. masers | 0 | 0 |
| Infrasonic, sonic and ultrasonic vibrations resulting from operation of an electronic circuit | | |
| a. infrasonic | 2 | 50 |
| b. sonic | 10 | 500 |
| c. ultrasonic | 10 | 500 |

Peace Corps - (a) The Peace Corps does use the following electronic products:

3 black and white television sets
1 color television set

(b) 5-10 persons per day use the black and white sets.

(c) None.

General Services Administration - GSA has service contracts with commercial communications carriers for circuits and equipment in support of the Federal Telecommunications System. In providing these circuits, all companies utilize microwave and other types of electronic equipment which emit electromagnetic radiation of the types shown in paragraph B-4 and 5 of P.H.S. Attachment I. These companies utilize microwave and other electronic equipment extensively, on a nationwide basis, and we have no information on the amount of such equipment or the extent of exposure, if any, to hazardous radiation.

Following is a list of reported equipment which may emit the types of radiation indicated in P.H.S. Attachment I, together with the estimated number of persons who may be exposed to such radiation.

| | | Estimated Exposure | |
|---|---|---|---|
| Kind of Equipment | Estimated Units | GSA & Contractor Personnel | Public |
| Television receivers | 5 | 15 | -- |
| Infrared ovens | Not available | Not available | Not certain |
| Microwave ovens | Not available | Not available | Not certain |
| Microwave voice transmission | See Paragraph Above | | |
| Ultraviolet lamps | 3 | 4 | None |
| Ultrasonic cleaners | 17 | 52 | None |
| Mercury arc lights | 5 | 10 | None |
| 15 MA X-ray sets | 2700 | 3 | None |
| Cryptographic units | Not available | 30 | Not certain |

Government Printing Office - The Government Printing Office does use a number of items indicated in Attachment I. We can give some estimate of our own equipment, but it is impossible to include our contractors.

a. A list of these items is contained as follows:

| Item | | Quantity |
|---|---|---|
| 1 | Cathode Ray tube | 10 |
| 2 | Oil tester 25000 volts | 1 |
| 3 | Electrostatic Static Neutralizer | 120 |
| 4 | U.V. generator lamps | 70 |
| 5 | Infrared heat lamps | 200 |
| 6 | Lead melting pots and ovens | 300 |
| 7 | High intensity white lamps | 40 |
| 8 | Microwave oven for food service | 1 |
| 9 | Miscellaneous sonic noise generated from machinery | 250 |

b. It is quite difficult if not impossible to estimate the number of personnel exposed to each item listed in (a). For example, a color television receiver in the auditorium can potentially expose the entire complement of personnel from this agency, namely 7500.

For all other devices we would estimate that an average of 3-4 persons could be exposed per device listed. However, due to the locations of some devices, some personnel may be exposed to several items.

c. The Government Printing Office is not normally open to the general public. Controlled tours are made occasionally to interested groups. We do not consider that any of our equipment would expose any member of these groups to hazardous radiation.

Smithsonian Institution - The various components of the Smithsonian reported on their possession and use of specific radiation producing sources from which the following summary inventory of sources was derived:

A.1 Radioactive material other than materials regulated under the Atomic Energy Act of 1954:

1 radium
3 other natural radionuclides

A.2 Electronic product sources of ionizing radiation:

9 X-ray machines
3 television receivers
1 klystron tube
2 electron microscopes
8 X-ray diffraction
1 electron beam welder
3 "other"

B.1 Ultraviolet

3 lamps
1 sterilizing device
15 "other"

B.2 Visible

15 white light devices
2 "other"

B.3 Infrared

15 dryers, ovens, and heaters

B.4 Microwave

1 alarm system
4 ovens
16 microwave power generating equipment
2 radar devices
1 signal generator

B.5 Radio and low frequency

1 cauterizer
5 power generation and transmission equipment
3 signal generators
2 "other"

B.6 Coherent electromagnetic (lasers/masers)

1 art, experimental, or educational laser
1 cutting and drilling laser
1 range finding laser
1 communication transmitter maser

C.2 Sonic

1 "other"

C.3 Ultrasonic

5 cleaners
1 ranging and detection device
1 "other"

Tennessee Valley Authority - Yes.

| Electronic Product or Radioactive Source | No. of Units | Number of TVA Personnel Potentially Exposed* |
|---|---|---|
| $^{226}Ra$ | 28 units (0.5 mCi each) | 10 |
| $^{226}Ra$ | 1 unit (3 mCi) | 4 |
| $^{241}Am$ | 47 units (80 μ Ci each) | 40 |
| $^{226}Ra$ | 1 unit (20 μ Ci) | 5 |
| Klystron tube | ~ 200 | ~200 |
| Medical diagnostic X-ray machines | 9 units (100 kVp, 100 ma to 125 kVp, 300 ma) | 48 |
| Dental diagnostic X-ray machines | 1 unit (70 kVp, 10 ma) | 5 |

---

*Contractor personnel is not normally admitted to areas where exposure to these devices is possible.

| Electronic Product or Radioactive Source | No. of Units | Number of TVA Personnel Potentially Exposed* |
|---|---|---|
| Radio & Low Frequency | | |
| Medical diathermy | 7 units (27.120 MHz) | 35 |
| Signal generator (transponder) | 3 units | 6 |
| Plasma torch | 1 unit | 3 |
| Function generator | 1 unit | 3 |
| Sonic | | |
| Medical vibrators | 6 units (0-2 watt/cm$^2$, 1 MHz) | 30 |
| Vibrator | 1 unit (20 KHz) | 2 |
| Oscillator | 2 units (20 KHz) | 4 |
| Cleaner | 8 units (three 10 KHz, two 20 KHz, one 80 KHz, two 36-40 KHz) | 33<br>33 |
| Nondestructive tester | 1 unit (0.05 to 2.0 MHz) | 6 |
| Level detector | 2 units (one 40 KHz, one 15.5 KHz) | 10 |
| Thickness measurer | 3 units (1-12 MHz each) | 10 |
| Light industrial radiographic machine | 2 units (140 kVp, 4 ma) | 6 |
| Neutron source ($^{226}$Ra-Be) | 1 unit (2 mCi) | 4 |
| Electron microscope | 1 unit (75 kVp, 20 $\mu$a) | 3 |
| X-ray diffraction | 3 units (30 kVp, 15 ma) | 3 |
| Ultraviolet | 12 units (9 lamps, 2 ozone generators, 1 zyglo light) | 30 |
| Infrared | | |
| Medical treatment | 15 units | 60 |
| Dryer | 16 units | 32 |
| Analyzer | 2 units | 6 |
| Spectrometer | 2 units | 6 |
| Heater | 6 units | 20 |
| Microwave | | |
| Radar | 3 units (one 50-watt, one 20-watt) | 10 |
| Signal generator | 2 units (100-watt each) | 6 |
| Oven | 4 units (2-watt each) | $\sim$400 |

---

*Contractor personnel is not normally admitted to areas where exposure to these devices is possible.

Selective Service System - For your information, this agency has several normal type television receivers and two radio transmitters. The TV sets are located in our National Headquarters. One radio transmitter is located in our National Headquarters and the other at our emergency relocation site.

U.S. Arms Control and Disarmament Agency - This agency's activities do not involve radiating devices and materials, with the minor exception of two television sets (one color and one black and white) located in the agency office area.

Civil Service Commission - Insofar as we can determine from discussion with ECA staff and review of our property records and contracts, only the following items contained in the list furnished are used by the Civil Service Commission:

1. Electronic Products

   1 - RCA Black and White television receiver
   3 - Setchel Carlson television receivers - Educator Model

These receivers are used in training classes. They are used each day. About 40 persons, all Federal employees, are exposed to each use.

In addition, in connection with its residential training programs, the Commission uses lodging facilities in which television receivers have been installed. We have no control over the make, model or usage of these receivers.

2. Ultrasonic Products - The Commission has an ultrasonic detection system installed for security in the building area which houses its Security Investigations Files. The system consists of a master unit and a series of receivers, or transducers. It operates on a frequency of 1900 vibrations per second and is activated only during off-duty hours when the file premises are not occupied. Thus, employees are not exposed to it.

U.S. Information Agency - The following list of equipment currently in use by the Motion Picture and Television Service may possibly emit types of radiation referred to in your Attachment I. Whether the level of emission is sufficiently high as to constitute a health hazard, I do not know. Perhaps your office could supply guidance since we have no means of measuring or evaluating the potential hazards of such emissions.

We use and maintain 62 Conrac black and white television monitors. The high voltage supply generates approximately 18 KV. The high voltage cage appears to be adequately shielded.

We use and maintain a total of 22 television receivers. High voltage supplies in these receivers range from 12 KV to 18 KV.

We have a Kinescope recorder which uses a cathode ray display tube requiring 25 KV, and an electron beam recorder using 20 KV as a high voltage supply. In our film screening facility we use seven projectors equipped with xenon projection lamps and two projectors equipped with carbon arc light sources.

We use nine low power (approximately 100 MW) wireless microphones and communication transmitter-receivers in the frequency range of 25.61 MHz to 27.205 MHz.

In the audible range we have one signal generator with an output level of 8 MW.

The estimated number of personnel who potentially may be exposed to radiation from the above sources is limited to the 40 members of the technical and film projection staff.

There is practically no chance that the general public or persons not under the control of this Agency could be exposed to radiation from these devices.

The VOA operates 40 high frequency transmitters in the United States (power ranges 50 to 500 kilowatts) and one medium-wave transmitter (50 kilowatts); overseas the VOA broadcasts on 54 high frequency transmitters (35 to 250 kilowatts) and 7 medium-wave transmitters (from 50 to 1000 kilowatts). These transmitters are coupled into antennas which, in some cases, are capable of up to 20db of antenna gain.

No personnel are knowingly exposed to dangerous radiation levels as outlined in answer 2.

The general public is not exposed to dangerous signal levels for the reasons outlined in answer 2. However, considering our broadcasting mission, we hope that many millions of listeners are exposed to radiation from our transmitters at safe receiving levels.

Recently, we were contacted by Mr. Bales and Dr. Lepak of your office, and we outlined for them our interests in the study of radiation hazards. We pointed out to them that the Voice of America (VOA), the broadcasting arm of the U.S. Information Agency, is involved in a worldwide broadcasting mission, utilizing primarily the high frequency broadcasting bands (in the range 5.95 to 26.1 Mc/s), and the medium-wave band (in the range 540 - 1600 Kc/s). This Agency does not manufacture electronic products nor knowingly generate ionizing radiation.

Veterans Administration - As reported by 166 hospitals and domiciliaries, the total estimated inventory of the Veterans Administration is tabulated as follows:

| Type of Material or Electronic Product | Number of Units in Operation |
|---|---|
| A. Ionizing Electromagnetic & Particulate Radiation: | |
| 1. Radioactive materials other than those regulated under Atomic Energy Act of 1954: | |
| a. Radium | |
| Needles | 559 (12 hospitals) |
| Capsules | 430 .3 mg. (5 hospitals) |
| b. Radon & daughters | 1 each |
| 2. Electronic products: | |
| a. X-ray machines | |
| Linear accelerators | 2 |
| Betatrons | 2 |
| Deep therapy conventional | 71 |
| Superficial therapy units | 40 |
| X-ray diffraction units | 3 |
| Radiographic only (stationary) includes headstands, GU chest units & tomograph | 492 |
| Radiographic (mobile) | 556 |
| Radiographic & fluoroscopic (stationary) - includes special procedure & cardiac type units | 569 |
| Radiographic & fluoroscopic (mobile) | 24 |
| Fluorographic units only | 68 |
| Dental radiographic (all types) | 335 |
| b. Television receivers | |
| Color | 973 |
| Black and white | 7776 |
| c. Neutron generators | 15 |
| d. Electron microscopes | 64 |
| e. Other | 58 |

| Type of Material or Electronic Product | Number of Units in Operation |
|---|---|
| B. Non-Ionizing Electromagnetic Radiation: | |
| 1. Ultraviolet: | |
| a. Biochemical & medical analyzers | 287 |
| b. Cosmetic & therapeutic lamps | 669 |
| c. Sanitizing & sterilizing devices | 450 |
| d. Other | 133 |
| 2. Visible light | |
| a. Very high intensity | 58 |
| b. Other | 141 |
| 3. Infrared | |
| a. Alarm systems | 1 |
| b. Dryers | |
| Ovens | 95 |
| Heaters | 333 |
| c. Other | 778 |
| 4. Microwave | |
| a. Diathermy units | 260 |
| b. Dryers | |
| Ovens | 25 |
| Heaters | 9 |
| c. Medico-biological heaters | 7 |
| d. Other | 19 |
| 5. Radio & low frequency | |
| a. Cauterizers | 283 |
| b. Diathermy units | 292 |
| c. Other | 79 |
| 6. Coherent electromagnetic | |
| a. Lasers | |
| Experimental devices | 1 |
| Biomedical analyzers | 4 |
| Cauterizing devices | 10 |
| Other | 6 |
| C. Infrasonic, Sonic & Ultrasonic Vibrations: | |
| 1. Ultrasonic | |
| a. Cauterizers | 15 |
| b. Cell & tissue disintegrators | 76 |
| c. Cleaners | 369 |
| d. Diagnostic apparatus | 104 |
| e. Other | 23 |

## APPENDIX 10

## REPLIES TO QUESTION 8

The following is a summary of the replies to Question 8 as provided by the departments and agencies queried. The detailed materials and supporting documents referenced in the replies are on file in the Bureau of Radiological Health.

> Question 8. Have there ever been any known overexposures to agency or contractor personnel from the types of radiation indicated in Attachment I? If affirmative, please briefly describe such occurrences and indicate where additional details can be obtained.

Department of State - "No."

Treasury Department - (Bureau of Customs) - We have had no known overexposure cases.

(Mint) - No known overexposure. Badges are read monthly. Largest reading on any one badge has been 90 units of gamma ray monthly.

(Engraving and Printing) - We know of no overexposures and feel additional measures neither necessary nor desirable.

Department of the Army - "Only about 70 people per year are reported to receive excessive exposures to ionizing radiation. These are very minor occupational exposures. There is no information available that would indicate that other personnel are receiving other types of radiation exposure."

Navy Department - (BUMED) - The Navy is familiar with the following two cases of LASER-caused injury.

Three years ago, while a student at the Naval Academy in Annapolis, a midshipman received in one eye a pulse of reflected LASER light from a pulsed ruby LASER during a laboratory experiment. This caused a burn in the macula of the eye. The injury was significant in that this man has maintained a visual acuity in the one eye of less than 20/20 and he has a small scotoma in his central vision in the one eye. However, he is presently on active duty as a Naval officer and is able to perform his duties without visual handicap. Medical records of this injury are in the file at the Naval Hospital in Bethesda, Maryland.

There is a civilian, now employed by the Navy, who sustained a LASER injury two years ago while working in a university physics laboratory (before being employed by the Navy). This injury also occurred to the macula of one eye. The visual acuity initially was reduced in the one eye, but subsequently recovered after several months to its pre-injury level of 20/15. There remains an ophthalmoscopically visible change in the macula, and a very small central scotoma is demonstrable, but this man has no visual handicap remaining. This case was reported in the medical literature (Archives of Ophthalmology, November 1967, Volume 78, pp. 596-99).

Although these cases represent accidental injury (and perhaps could have been prevented as any accident can "theoretically" be prevented) and indicate that the hazard from LASERS is a real one, it should be pointed out that no significant LASER-related injury has occurred in the Navy during the three years since the time of occurrence of case (a), despite a good deal of on-going LASER research and development. It is believed that the workers involved in LASER work in the Navy are sufficiently aware of the danger that the probability of more accidents occurring is quite low.

The Bureau of Medicine and Surgery is not aware of any cases of microwave overexposure, although it has been stated that a human fatality did occur due to microwave exposure in 1957. Further information is available from Doctor D. Beischer, Naval Aerospace Medical Institute, Naval Aerospace Medical Center, Pensacola, Florida, regarding the fatality.

There are approximately 1 to 2 instances per month of Naval personnel exceeding maximum permissible ionizing radiation exposure limits. The Navy processes approximately 40,000 film badges per month. The Radiological Safety program appears to be extremely effective as evidenced by the small incidence of reported overexposures. The records of overexposure to ionizing radiation are on file at the Bureau of Medicine and Surgery, Code 742.

Department of the Air Force - A.1 There have been no known overexposures in the Air Force to the radioactive materials cited of type A.1.

A.2 There have been known overexposures to film badges worn by agency personnel working with X-rays. The USAF Film Dosimetry Program was started in 1955 and since that time 217 overexposures to X-rays have occurred. It would be undue transcribing of data to give an account of each in this document. However, we can supply such information if desired by Congress. In general, X-ray technicians were involved and the exposures were, in most instances, accidental. There have been no known overexposures in the Air Force to other above-cited electronic products.

B.1, B.2, B.3, B.5, C.1, C.2, C.3 There have been no known overexposures to the types of radiation covered by these sections.

B.4 No documented cases of personnel overexposures to these sources of microwave have been reported.

B.6 There have been no documented cases of known overexposure to coherent light sources involving USAF personnel.

Justice Department - We (Bureau of Prisons) have averaged one suspected x-ray overexposure per month during the past year. Enclosed is a typical investigation report of a case dated April 29, 1969. All of these have been a result of negligence by the individual; some resulted in overexposure of the film badge only.

Post Office Department - No--according to the Industrial Medical Division.

Department of Interior - None, with the exception of eye injuries resulting from exposure to electric arc welding. The reporting Bureau (Reclamation) stated the flash burns resulting from such exposure were due to failure to observe established safety requirements and that most injuries were relatively minor.

There have been no known overexposure to Bureau of Mines personnel from radiation. Cases of overexposure to uranium miners from radon-daughters are well documented.

Department of Agriculture - We have on record one incident which an authorized user's film badge showed an exposure of 30 rem beta. This occurred while an X-ray diffraction unit was being re-aligned by the manufacturer. Investigation revealed that the incident was an unusual one in that, by coincidence, a narrow X-ray beam struck the wearer's badge while he was observing the re-alignment procedure. Upon medical examination it was established that the wearer experienced no detectable adverse affects of any kind. A complete report of the incident was prepared and is available from the RSO's files.

There have been five reported cases where employees have received burns from exposure to ultraviolet radiation. Three of these were reported from the Cotton Insects Research Laboratory, Brownsville, Texas, when the employees were installing ultraviolet bulbs in a decontamination chamber on February 7, 1969. No permanent injury or damage was sustained in any of the five cases.

Department of Commerce -

(NBS) - No.

(ESSA) - No.

(Maritime) - No.

Department of Labor - "None."

Department of Housing and Urban Development - "None."

Department of Transportation - There has never been any known overexposures to DOT or contractor personnel from any of the types of radiation as indicated in Attachment I. There also have been no known overexposures to the public or to transportation workers as a result of radiation from packages of radioactive materials in the transportation environment. In conjunction with this aspect, an interagency project was initiated in 1968 between the DOT, AEC, and HEW, entitled "Joint Survey of Radioactive Materials Shipments." This project is expected to be completed in late 1969. Enclosed is a copy of the Project Plan, which outlines its background, purpose, and scope in greater detail.

Agency for International Development - A few cases of overexposure to X-ray, not associated with performance of official duties, have been heard of; however, I assume that these were reported officially and will, in turn, be reported to you by those agencies responsible for health of employees and their dependents.

Atomic Energy Commission - A summary of "operational Accidents and Radiation Exposure Experience" published December 1968 is enclosed for your use.

District of Columbia Government - Since 1964, when records of exposures were centralized and maintained, there have been a total of 21 radiation doses reported in excess of 400 millirems in one month. These have all been investigated and details of each exposure are available from the Radiological Health Division, D.C. Department of Public Health. In most cases, these exposures were associated with X-ray equipment. The highest recorded dose (25 rems) occurred as a result of a defective X-ray machine which failed to terminate the exposure when the dead-man switch was released.

Federal Communications Commission - To the best of our knowledge there have been no cases of overexposure to employees of this Commission or contractor personnel from the types of radiation listed in your Attachment I.

General Accounting Office - "No."

Interstate Commerce Commission - "No."

National Aeronautics and Space Administration -
(Ames Research Center) - Here at Ames, we have never had a known overexposure or high exposure (over 200 mr) for any one month.

(Electronics Research Center) - This Center has not had any known overexposures to installation or contractor personnel from the types of radiation specified.

(Flight Research Center) - None.

(Langley Research Center) - None.

(Lewis Research Center) - Despite the use of a wide range of radiation producing machines and materials, there have been no overexposures to personnel during the last three years.

There have been no known overexposures to personnel or contractors employed at the Plum Brook Reactor Facility, or to the general public.

(Jet Propulsion Laboratory) - We had an incident of a X-ray technician who operated a X-ray tube pointing at a sheet of lead on the wall four feet away and received a 2.5 Rem exposure of soft scatter X-rays. No damage or injury resulted. We had several persons receive a sunburn of the skin and eyes when the twenty-five foot space simulator was first put into operation with 150 2KW ultraviolet Xenon lamps turned on. There were no lasting effects.

(Mississippi Test Facility) - There have been no known overexposures from any form of radiation in the medical services or in the laboratory activites.

(Michoud Assembly Facility) - Boeing - Negative. Chrysler - Negative. Mason-Rust - Negative.

(Goddard Space Flight Center) - There has been no record of injury or other ill-effects from the radiation produced by the devices listed in Part I of this report.

(Manned Spacecraft Center) - The only overexposure that has been reported was a case of conjunctivitis from exposure to germicidal ultraviolet lamps used in the Lunar Receiving Laboratory.

Peace Corps - "No."

General Services Administration - There have been no known overexposures to GSA or contractor personnel from the types of radiation indicated in P.H.S. Attachment I.

Government Printing Office - "No."

Department of Health, Education, and Welfare - (National Institutes of Health) - NIH indicates 3 instances of burns from X-ray diffraction equipment and approximately a dozen instances of burns from ultraviolet light.

(Health Services and Mental Health Administration) - HSMHA, in the Indian Health Service and Federal Health Programs Service, have had occasional film badge overexposures.

(Food and Drug Administration) - No overexposures to radiation have ever been recorded for FDA employees.

(Environmental Control Administration, Bureau of Radiological Health) - No - overexposures for agency personnel. Yes - overexposure for contractors namely the Indian Health Service and the Bureau of Prisons. BRH handles the film badge service for these agencies and other PHS agencies.

Tennessee Valley Authority - "No."

Arms Control and Disarmament Agency - "None."

U.S. Information Agency - No. We know of no incidents of overexposure to Agency or contractor personnel from our transmitters if we are to accept the 10 mw/sq. cm. safety level cited in answer 2.

Veterans Administration - Records fail to indicate any serious overexposure to agency personnel from X-ray or radium radiation. Occasionally we do receive a film badge monitoring report indicating that a certain technician has exceeded the permissible weekly dose. In most instances of this type, follow-up has disclosed that either the technician left his badge lying around in the diagnostic room or has been wearing it on top of his lead rubber apron.

## APPENDIX 11

## REPLIES TO QUESTION 9

The following is a summary of the replies to Question 9 as provided by the departments and agencies queried. The detailed materials and supporting documents referenced in the replies are on file in the Bureau of Radiological Health.

QUESTION 9. What additional measures do you feel are necessary or desirable to insure uniform and effective control of health hazards from electronic product radiation and other types of ionizing radiation, as indicated in Attachment I?

State Department - Manufacturers of radiation-producing products should be required to furnish the user with the radiation level emitted and amount of protection required. This would make the user aware of the hazard and prompt him to take proper precautions.

Treasury Department - (Bureau of Customs) - We do not believe any additional control measures are needed in Customs to safeguard personnel.
(Mint) - No additional measures necessary to maintain control.

Department of the Army - "The continuously rapid technical development and increasing number of items of potential health hazards being introduced into our society should require that the manufacturer of a product, which may be potentially hazardous to the user or the general public, be required to state on each item the fact that "this item may be hazardous to the user or general public." The user should be advised by the manufacturer to read operating instructions and hazard analysis report before operating the device. It would then become a management problem or a commander's responsibility to see that the item is used as specified by the manufacturer for the safety of the employee and/or general public. It is a known fact that many users are employing devices that may be potentially hazardous if not utilized properly, yet, these same people are completely unaware of these potential hazards."

Navy Department - (BUMED) - "The following additional measures are desirable to insure uniform and effective control of health hazards from electronic product radiation: (a) The establishment of uniform threshold damage values for microwave and LASER radiation. The values should ideally be predicated on human data or if this is not possible extrapolated from animal research. The entire frequency spectrum should be assessed to provide complete threshold data. (b) An environmental survey capability is required to periodically survey microwave, LASER, and ionizing radiation facilities in order to effectively control health hazards."

(NAVSUP) - "An important measure to insure uniform and effective control of radiation hazards would be to establish parameters for each type of radiation. The below listed items are considered necessary: (1) Instructions on radiation limits. (2) Uniform control measures including inspections with radiation level readings. (3) Standard labelling or signing of each hazardous radiation source; classifying type, degree, and treatment of hazard. (4) Standard specifications for procurement of radiation-type items including control measures for the elimination of health hazards."

(NAVFAC) - "Development of standards of permissible exposures. Establishment of training facilities to assure knowledgeable monitoring. Development of monitoring instrumentation."

Department of Justice - "Relative to laboratory materials and equipment we believe it would be desirable to have hazard information furnished for each item so that personnel would be fully aware of any problems that might exist, if any, in connection with their use."

(Bureau of Prisons) - "It would be extremely beneficial to us if all Federal specifications (GSA, VA, DOD, PHS) developed the following items including standards for control of health hazards: (a) radar; (b) twoway radios; (c) television receivers; (d) test instruments; (e) X-ray machines; (f) diathermy units; (g) ultrasonic physiotherapy equipment; (h) ultrasonic cleaners; (i) ultraviolet lights; and (j) infrared lamps in physiotherapy. It would also be appropriate to have one Government agency at least coordinate these health hazard standards, so all agencies can contact them for information.

Post Office Department: - Industrial Medical Division's Contribution: "This is impossible to answer at the present time due to lack of funds for this purpose; it will depend on our acquisition of such equipment in the future as: (a) diagnostic X-ray; (b) clinical laboratory; (c) electrocardiograph; (d) physiotherapy equipment; (e) diathermy; (f) hydrotherapy. (Note: fluoroscope, regular X-ray exposure and diathermy have radiation possibilities.)

All standards established by competent authority will be reviewed and all necessary precautions will be taken at the time of acquisition of such equipment and before its operation. The professional personnel involved will have been instructed by the proper authorities in the control of its operation and with the establishment of all regulation safeguards for the protection of the users and operators of such equipments."

Bureau of Research and Engineering's Contribution: "Radiation monitoring devices for postal equipment, or radiation monitoring equipment, purchased for postal use, were not evidenced throughout the period of the study.

The prevalent attitude among the individuals contacted, during the course of the study, was that if the equipment was of standard make and purchased off-shelf, it did not present any potential health hazard.

The foregoing attitude neglects to take into account the average wear and tear from usage and natural deterioration from age. Therefore, it is recommended that mandatory controls be established (and authority vested with an agency such as the Department of Health, Education and Welfare) for periodic inspection by competent authority of all equipment falling under the categories of electronic product or other type of ionizing radiation to preclude the possibility of any health hazard.

Department of Interior -
(Office of Saline Water) - "Standard procedures to be observed for each type of hazard should be detailed, widely distributed and every equipment supplier should be required to include a copy of the standard with each item of equipment sold."

(Bureau of Reclamation) - "To our knowledge, Reclamation is taking effective and adequate health and safety measures to cope with known and recognized hazards from electronic product radiation and other types of radiation. Obviously, in some instances, these measures are based on the assumption that commercially available electronic equipment is properly shielded and that the health and safety standards promulgated by associations, standard committees, and the manufacturers are realistic and adequate. In our opinion, HEW could best serve the interest of the Federal agencies and the public in the following manner:

A. Cooperate with the United States of America Standards Institute, The American Conference of Governmental Industrial Hygienists, the Federal Radiation Council, and other associations in the promulgation of effective minimum health and safety standards pertaining to the manufacture and use of electronic equipment.

B. Promote objective research relating to radiation hazards from specific electronic devices, particularly lasers, range-finding devices, television receivers, and radio transmitters. Based on the results of such research, minimum design specifications and health and safety standards incident to the use of the equipment could be promulgated and published. In cooperation with the National Electrical Manufacturers Association or The Institute of Electrical and Electronic Engineers, Inc., it may be feasible to develop a seal, similar to Underwriters Laboratories, to indicate compliance with established health and safety standards for electronic equipment.

C. Actively participate with the General Services Administration, Washington, D. C., in the promulgation of Federal Specifications governing

Government purchase of electronic equipment. Federal Specifications are used extensively by Government agencies in purchasing equipment, and, in our opinion, should be expanded to include most of the electronic equipment covered in this study.

D. Consideration may be given to development of a simple monitoring device, similar to ionizing radiation film badges, which would indicate injurious levels of radiation from the sources listed in Attachment I.

Other agencies either felt that no additional measures were required as far as individual agency use of electronic products was concerned or that recommendations would not be appropriate in view of the limited use of electronic products within the agency.

Those measures which the Federal Water Pollution Control Administration considers to be necessary are provided for in the "Radiation Control For Health and Safety Act of 1968." Specifically, this includes: a) determination of the appropriate tolerance limits for the various forms of radiation, b) development of appropriate radiation protection standards for occupational exposure and exposure of the general public, c) development of suitable monitoring equipment and techniques, and d) appropriate markings (prominently displayed) on each manufactured product to indicate the type and intensity of the emitted radiation (s). Further, each unit of equipment should be accompanied by a complete set of operating instructions which take due cognizance of the emitted radiation(s) and describe in detail the radiation safety procedures and precautions which must be followed.

In closing this section, I should note that the other agencies did not have the opportunity to review the "Radiation Control for Health and Safety Act of 1968."

(Bureau of Mines) - "We feel that uniform standards and operating procedures should be promulgated for the types of electronic products listed under Sections B and C, Attachment I."

Department of Agriculture -
(Agriculture Research Services) - "We consider that manufacturers of electronic products should be required to design and build them in such a manner, i.e., proper shielding, proper safety controls, interlocks where appropriate, proper warning labels, etc., that they can be operated safely without having to be surveyed by a radiation expert before they are used. If electronic equipment does present a potential health hazard, this should be clearly pointed out in appropriate warning tags and in the descriptive material furnished with the products. Instructions and procedures for operating the products safely should then be furnished. All products should be carefully inspected, operated and surveyed before release to the consumer and a certificate should accompany each product stating that it is in proper working condition and is

safe when operated in accordance with prescribed instructions. In brief, manufacturers should place as much emphasis on safety of their products as their sales departments do on sales promotion. It is believed that the above will be accomplished with proper implementation of the Radiation Control for Health and Safety Act of 1968. Additional measures which would be desirable could include: (a) The development and conducting of simplified, low cost training courses specifically relating to health hazards; and (b) the development and publication of material relating to health hazards of electronic product radiation."

(Consumer and Marketing Service) - "If the two types of instruments mentioned in 7a (i.e. UV lamps and microwave ovens), can constitute health hazards, we feel that it would be desirable to have standards for their use."

(Forest Service) - "Periodic short courses attended by our Lab Radiological Officer would be desirable to insure uniform and effective control of health hazards from radiation."

Agency for International Development - "In compliance with the intent of the Radiation Control for Health and Safety Act of 1968, I am of the opinion that strong regulations, standards, directives and specifications should be provided to control health hazards from these types of radiation. These regulations should be standard for the U.S. Government with such additions from each Agency involved to provide for their variations and additional requirements rather than have each agency program a separate set of regulations. We will support such preparation and will prepare the supporting additional requirements to control the sale, installation, use and monitoring requirements for this Agency as it is concerned with foreign aid to developing countries in whatever form that aid is provided. (Equipment for export clearly should be subject to the same regulations that apply to equipment used within the United States and all such equipment, whether for domestic use or export, should clearly be identified as a potential radiation hazard. Manuals giving necessary instructions on safe use should be required to accompany each unit of such equipment.)"

Department of Transportation - "Our only recommendation, which is simply a restatement of one of the principal purposes of the "ACT" is that performance standards should be developed to apply to the quality control in the manufacture of electronic products, so as to properly control any hazards due to emission of radiation from such equipment."

Department of Commerce -
(NBS) - "HEW should complement the AEC with a consistent set of rules and regulations similar to 10 CFR."

(ESSA) - "Mandatory national standards are necessary. General specifications should be prepared for all DOC procurement. Test and measurement techniques should be made available."

(Maritime) - "None."

Labor Department - "This is not a problem in our agency."

Department of Housing and Urban Development - "Industry standards should be developed and factory tests enforced through policing and labeling methods to insure consumer/user protection. Nationally recognized organizations such as Underwriter's Laboratories, National Electric Safety Code and the National Safety Council could provide the expertise."

Atomic Energy Commission - "We note that there are several sources of exposure listed in Attachment I for which no safety standards exist, i.e., infrared, infrasonic, sonic, and ultrasonic vibrations. Therefore, it is difficult to evaluate the significance of human exposures from these sources and a need for standards should be investigated. Should insufficient information be available to determine the risk to human health from these sources of exposures and to permit the development of standards, where needed, then research efforts should be encouraged to resolve the areas of uncertainty."

Civil Aeronautics Board - "None".

District of Columbia Government - "Full implementation of PL 90-602. Licensure of radiologic technologists with interstate reciprocity agreements. Minimal training requirements for all users in the healing arts of X-ray equipment and radioactive material. Uniform radiation control regulations in all states and territories. Revising federal specifications on X-ray equipment every three years, and developing federal specifications for other hazardous radiation devices, such as microwave ovens."

Federal Communications Commission - "Some additional measures desirable to control health hazards from electronic product radiation would be the establishment for each type of radiation of suitable criteria, such as construction requirements or allowable intensities, together with development of suitable standard measurement procedures applicable to the different types of radiation. As suggested above, it may be desirable to give a high priority to industrial heating and industrial ultrasonic apparatus."

General Accounting Office - "None"

Interstate Commerce Commission - "Because of our limited jurisdictional authority in the field now, we make no comment, except to support the intention of the statute and your study to the end that improved safety for the public and employees will result."

National Aeronautics and Space Administration -
(Ames Research Center) - This office would appreciate continued dissemination of information on new types of equipment found to emit any of the named types of radiation at significant levels and communication of radiological problems experienced by others.

(Electronics Research Center) - Additional measures which should be considered for inclusion in the radiation protection program would be procedures and/or specifications for procurement and/or disposal of radiation producing equipment or devices.

(Flight Research Center) - None

(Langley Research Center) - On a national level, research should be accelerated to develop criteria in the area of concern.

(Jet Propulsion Laboratory) - We need more funding and people to carry out a better program in the safety area. This would enable us to have all purchase requests of equipment producing radiation of any type to be approved by the JPL Safety Office.

(Mississippi Test Facility) - It is felt that no additional protective measures are necessary in the operation of the medical equipment nor is there any needed in the laboratory services for the level and quality of work performed.

(Goddard Space Flight Center) - The following additional measures are suggested to improve the control of health hazards from electronic devices listed in Part I of this report.

a. A standard, distinctive, conspicuously visible "X-ray On" light mounted on or near the x-ray machine which would be energized when high voltage was applied.

b. High voltage surge tubes should be standardized so as to preclude the emission of x-rays. The most acceptable design would be adopted as the standard and manufactured on a royalty-free basis.

c. Lasers should be given a letter or number designation at the factory under federal or state supervision. This designation would be indicative of the potential hazard of the device (e.g., "001", device is inherently safe; "010", high probability of anyone in the area receiving a retinal lesion without eye-protection.) Control would than be exercised by the states or user institution based on this classification. For example, no control be exercised over units designated "009" or below; while, local registration might be required above "010" and state registration above "025". Sale of devices "050" or above would be permitted only after the prospective purchaser had been determined qualified by the responsible federal agency.

d. A study should be funded by the federal government to determine a model for laser and microwave interaction with living matter. This study should also establish a cause-effect relationship (biological damages) for each of the control parameters selected.

(Manned Spacecraft Center) - Health Hazard Bulletins are being developed for non-ionizing radiation such as ultraviolet, infrared, and microwave. In addition, continuing surveys and studies will be conducted to evaluate exposure to electronic product radiation. An "Electronic Product Registration" has been proposed for use at MSC as a means of inventorying sources of electronic product radiation. It is considered that the above will be adquate to fully evaluate health hazards from personnel exposure. (Attachment 3).

Peace Corps -"None"

General Services Administration - "It is considered essential that standards and directives be developed by PHS for the assistance of the agencies in the effective control of the types of hazards under consideration. Further, the development of educational and training programs for use by the agencies would be helpful in working with persons subject to exposure to such radiation."

Government Printing Office - "The Government Printing Office believes that there does exist a serious lack of safety standards on radiation outlined by Attachment I in your letter.

We feel that it will be first necessary that a competent research group establish which forms of radiation present a health hazard and then determine those levels at which the hazard is detrimental. Once these facts are established, then industry can develop realistic standards from which minimum hazard equipment can be constructed and used."

Department of Health, Education, and Welfare -
(National Institutes of Health) - "The major effort should be directed at the manufacturer and the establishment of standards to be met prior to sale. They also suggest instituting better control over the fate of surplussed equipment that could be potentially, if not actually, hazardous."

(Health Services and Mental Health Administration) - "There is an additional need in training programs for personnel working with radiation equipment for increased emphasis on proper procedures, techniques, and maintenance of equipment. Additional standards and information is needed on many of the products listed on the inventory attachment."

(Environmental Control Administration, Bureau of Radiological Health) - "For additional measures necessary or desirable to insure uniform and effective control of health hazards from electronic radiation and other types of ionizing radiation. See Part II C. Recommendations."

Smithsonian Institution - "With reference to the desirability of additional measures to insure uniform and effective control of health hazards from electronic product radiation, we suggest that some impartial group outside the Smithsonian be authorized to make inspections, if needed."

Tennessee Valley Authority - "In our opinion, Public Law 90-602 established the foundation for control of health hazards produced from electronic product radiation and radiation sources not covered in the Atomic Energy Act of 1954. Issuance of standards, guidelines, and controls, such as those given in Title 10, Code of Federal Regulations, would be a method of obtaining uniformity and effective control in all Federal agencies as well as providing guidance for state regulatory agencies in establishment of their programs."

Civil Service Commission - "Since the Commission has no scientific or technical competence in this field, we are not in a position to suggest additional standards or additional control measures. However, I want to emphasize that the Civil Service Commission in exercising its responsibilities for providing leadership to the entire Federal establishment for the planning, development and operation of a modern, comprehensive personnel management program, is vitally concerned that an adequate program of occupational health and safety be provided in each agency for the benefit of its own work force. For that reason, we are gratified that the Environmental Control Administration is making this study to identify the present control of health hazards from electronic products and other types of ionizing radiation and to determine what additional control measures may be necessary."

U.S. Information Agency - "Development of practicable procedures and devices for detection and measurement of radiation would insure proper and adequate control for this Agency and other agencies who are users of the type of equipment listed. In those cases where sophisticated measuring equipment and more complex procedures are required to investigate and evaluate possible radiation hazards and where it would be too costly and impractical for the using Government agency to invest in such equipment for one-time only or occasional use, I recommend that HEW or some other appropriate Government department or agency acting for Hew set up a mobile team of qualified technicians who have been thoroughly trained in radiation hazards, detection, techniques, and equipment. The services of this team of specialists could be made available to all Government users of electronic equipment, on request, for evaluation of existing equipment. This team could also make necessary recommendations and furnish guidance that would enable Government users to comply with the provisions of Public Law 90-602. As an example of the need for the above, the electron beam recorder mentioned earlier in this report is the first of its kind. It utilizes electron bombardment as the exposure vehicle to transfer a television signal to motion picture film. We were concerned about possible hazardous radiation from this device last year and were able to borrow a Victoreen Instrument Company geiger counter (Model 6A) from the Washington, D. C. Civil Defense Unit. In addition, personnel working in the area of the electron beam recorder were supplied with Bendix Dosimeters. Both tests were negative, but I am not convinced that these were the proper tests for this device or to what degree our results are valid. In summary, the first step to insure uniform and effective control of radiation from existing electronic equipment is to develop the ability of the user to detect and measure hazardous radiation. We believe that additional research is necessary to establish a radiation safety standard for humans and animals which may be applied to each part of the electromagnetic spectrum and which takes into consideration frequency effects, type of modulation, exposure time, power density and field effects, non-thermal effects as well as thermogenic effects, wave polarization effects, etc. We believe that such a safety standard will require many years of clinical and laboratory research. However, in the interest of those operating Agencies requiring immediate guidelines for protection from possible electromagnetic radiation hazards, it is recommended that an extensive effort be launched by the Department of Health, Education, and Welfare in conjunction with other interested agencies, commercial groups, and University laboratories, to establish an officially sanctioned interim safety standard for each portion of the radio spectrum which could be applied until more sophisticated and protracted research studies can be successfully pursued in the future."

Veterans Administration - "A manual similar to M-2, Part XI (EXHIBIT 1) which currently applies to hazards from radium and X-ray radiation only, should be developed to cover all other types of ionizing radiation indicated in ATTACHMENT I. In the interim, it should be made mandatory that each manufacturer label his product of the ATTACHMENT I category with a warning plate similar to one now used on all X-ray generators. The warning plate stipulates that the particular apparatus is to be used only by trained and qualified personnel."

The ABSTRACT CARDS below are designed to facilitate document retrieval using Coordinate Indexing. They provide space for an accession number (to be filled in by the user), suggested key words, bibliographic information, and an abstract.

The Coordinate Index concept of reference material filing is readily adaptable to a variety of filing systems. Coordinate Indexing is described in the publication "IBM Data Processing Techniques - Index Organization for Information Retrieval" (C 20-8062). Copies are available through IBM Branch Offices.

The cards are furnished in triplicate to allow for flexibility in their use (e.g., author card index, accession number card index).

Accession No.

Division of Electronic Products:
PRESENT FEDERAL CONTROL OF HEALTH
HAZARDS FROM ELECTRONIC PRODUCT
RADIATION AND OTHER TYPES OF IONIZING RADIATION.
U.S. Department of Health, Education, and Welfare,
Public Health Service Publication Number BRH/DEP 70-28
(November 1970), 208 pp. (limited distribution).

ABSTRACT: This report documents the results of a survey which was performed during the period from June to October 1969 to investigate the various facets of Federal radiation control. The items investigated included statutory control authority, control programs and procedures, and the quantities and various types of radiation-emitting electronic products and radioactive materials used by the Federal government.

(over)

Accession No.

Division of Electronic Products:
PRESENT FEDERAL CONTROL OF HEALTH
HAZARDS FROM ELECTRONIC PRODUCT
RADIATION AND OTHER TYPES OF IONIZING RADIATION.
U.S. Department of Health, Education, and Welfare,
Public Health Service Publication Number BRH/DEP 70-28
(November 1970), 208 pp. (limited distribution).

ABSTRACT: This report documents the results of a survey which was performed during the period from June to October 1969 to investigate the various facets of Federal radiation control. The items investigated included statutory control authority, control programs and procedures, and the quantities and various types of radiation-emitting electronic products and radioactive materials used by the Federal government.

(over)

Accession No.

Division of Electronic Products:
PRESENT FEDERAL CONTROL OF HEALTH
HAZARDS FROM ELECTRONIC PRODUCT
RADIATION AND OTHER TYPES OF IONIZING RADIATION.
U.S. Department of Health, Education, and Welfare,
Public Health Service Publication Number BRH/DEP 70-28
(November 1970) 208 pp. (limited distribution).

ABSTRACT: This report documents the results of a survey which was performed during the period from June to October 1969 to investigate the various facets of Federal radiation control. The items investigated included statutory control authority, control programs and procedures, and the quantities and various types of radiation-emitting electronic products and radioactive materials used by the Federal government.

(over)

Thirty-three selected departments and agencies were asked to answer specific questions relating to their programs for controlling radiation from electronic products and radioactive materials. Their responses are summarized and discussed.

KEYWORDS: Electronic product radiation control; Radioactive material control; Radiation health hazards; Federal radiation control programs; Radiation safety surveys.

Thirty-three selected departments and agencies were asked to answer specific questions relating to their programs for controlling radiation from electronic products and radioactive materials. Their responses are summarized and discussed.

KEYWORDS: Electronic product radiation control; Radioactive material control; Radiation health hazards; Federal radiation control programs; Radiation safety surveys.

Thirty-three selected departments and agencies were asked to answer specific questions relating to their programs for controlling radiation from electronic products and radioactive materials. Their responses are summarized and discussed.

KEYWORDS: Electronic product radiation control; Radioactive material control; Radiation health hazards; Federal radiation control program; Radiation safety surveys.

# DIVISION OF ELECTRONIC PRODUCTS

## List of Publications

(continued from inside of front cover)

| | Title |
|---|---|
| BRH/DEP 70-11 | Leakage Variations from Microwave Ovens (June 1970) (PB 192 042) |
| BRH/DEP 70-12 | The Effect of Instrument Averaging Time on Microwave Power Density Measurements (June 1970) (PB 192 322) |
| BRH/DEP 70-13 | Variability in the Automatic Processing of Medical X-ray Film (June 1970) (PB 192 702) |
| BRH/DEP 70-14 | Simple X-ray Detection Instruments for Television Service Technicians (June 1970) (PB 192 377) |
| BRH/DEP 70-15 | A Partial Inventory of Microwave Towers, Broadcasting Transmitters, and Fixed Radars by States and Regions (June 1970) (PB 193 542) |
| BRH/DEP 70-16 | Near Field Instrumentation (July 1970) (PB 192 748) |
| BRH/DEP 70-17 | Radiation Safety Surveys of X-ray Facilities Within the Federal Health Programs Service (July 1970) (PB 192 957) |
| BRH/DEP 70-18 | Bremsstrahlung Production (July 1970) (PB 192 888) |
| BRH/DEP 70-19 | Radiation Safety Surveys of X-ray Facilities Within the Bureau of Prisons During 1968 (July 1970) (PB 193 222) |
| BRH/DEP 70-20 | Investigation of the Response of the Microlite 287 Probe to Microwave Fields (August 1970) (PB 193 223) |
| BRH/DEP 70-21 | Evaluation of an X-radiation Dosimetry Service for Home Television Receivers (August 1970) (PB 193 487) |
| BRH/DEP 70-22 | Report of Tests for X- ray Emission from a Rayotron® Electrostatic Generator and Particle Accelerator (August 1970) (PB 193 522) |
| BRH/DEP 70-23 | Microwave Oven Test Load Evaluation and Determination of Internal Microwave Energy Distribution (August 1970) (PB 193 804) |
| BRH/DEP 70-24 | In-Plant Survey of Television Receivers for X-radiation Emission Capability (September 1970) (PB 194 316) |
| BRH/DEP 70-25 | Laboratory Testing and Evaluation of Microwave Ovens (October 1970) (PB 194 484) |
| BRH/DEP 70-26 | Electronic Product Radiation and the Health Physicist - Health Physics Society Fourth Annual Midyear Topical Symposium (October 1970) |
| BRH/DEP 70-27 | A Study of Head and Neck Exposure from Polytomography (November 1970) |
| BRH/DEP 70-28 | Present Federal Control of Health Hazards from Electronic Products Radiation and Other Types of Ionizing Radiation (November 1970) |

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Public Health Service
Bureau of Radiological Health
Rockville, Maryland 20852

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF H.E.W.

If you do not desire to continue receiving this technical report series, please CHECK HERE ☐ ; tear off this label and return it to the above address. Your name will then be promptly removed from the appropriate mailing list.

RECEIVED
DEC 17 1970
INPUT SECTION
CLEARINGHOUSE

BRH/DEP 70-28